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PUBLIC WORKS

An Engineering and Construction Monthly

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CITY COUNTY STATE

PUBLIC WORKS is devoted to the design, construction, maintenance and operation of *public improvements.*

The major subjects covered are: Highways, Water Supply, Sewerage, Refuse Collection and Disposal, Street Cleaning, Bridges, etc.

Vol. 61 July, 1930 No. 7

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If Winter Comes:

Winter generally comes pretty regularly in these sections—though it wasn't so down in sunny Alabama—and with it comes a train of troubles for the city and county engineer. Snow falls, long lines of motors slow down; congestion; business at a standstill; suffering; sometimes a food shortage.

The remedy is adequate planning for snow removal. Perhaps snow removal has been with us for too few years for most of us to appreciate the magnitude and importance of the problem it presents. The fact that it pays for itself in many ways, a number of times over—increased gasoline tax, decreased maintenance costs, etc.—is often forgotten. Preparation for it is postponed too long.

Problems of snow control for states, counties and cities will be discussed fully in the next few issues of *Public Works*. August is none too early to look over equipment, plan budgets, and prepare for the worst that winter can bring. Let's go!

In This Issue:

The third and final article on "Making the Road Money Go Further" describes the method of constructing the retread top in such detail as to be of maximum value to our readers interested in low cost roads. That this subject is of importance to other than county and state engineers is shown by the article contributed by Mr. Brinkley, who points out that many small municipalities face the same problem of providing good-riding streets on small budgets. More about smooth-riding bituminous highways by Mr. Donovan. Also, an unusual collection of articles for the sanitary engineer, covering refuse disposal methods in New Orleans, which has always been among the leading cities in this regard; sewage treatment and sludge disposal matters of interest to everyone faced with this often vexatious problem. In water supply, also, several excellent articles.

In Forthcoming Issues:

It is always pleasant to think of snow removal during the hot days of July and August, and the next issue will present a number of atricles on this subject. What we think is the best article on efficiency in concrete highway construction that has ever been contributed to us has been prepared by a leading state highway engineer. More articles on low cost roads. A description of the design of one of the latest and best activated sludge plants in the east. Corrosion in underground metal structures. A summary of trade waste treatment practice. These and many others are in our files for early use.

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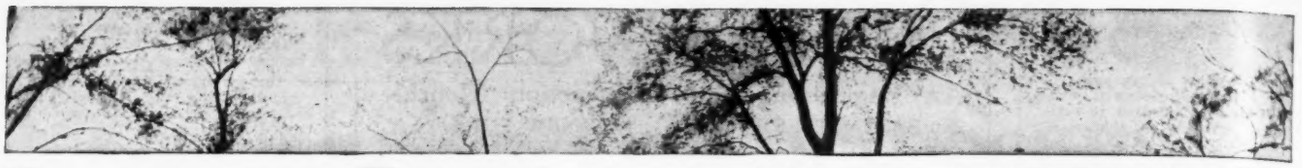

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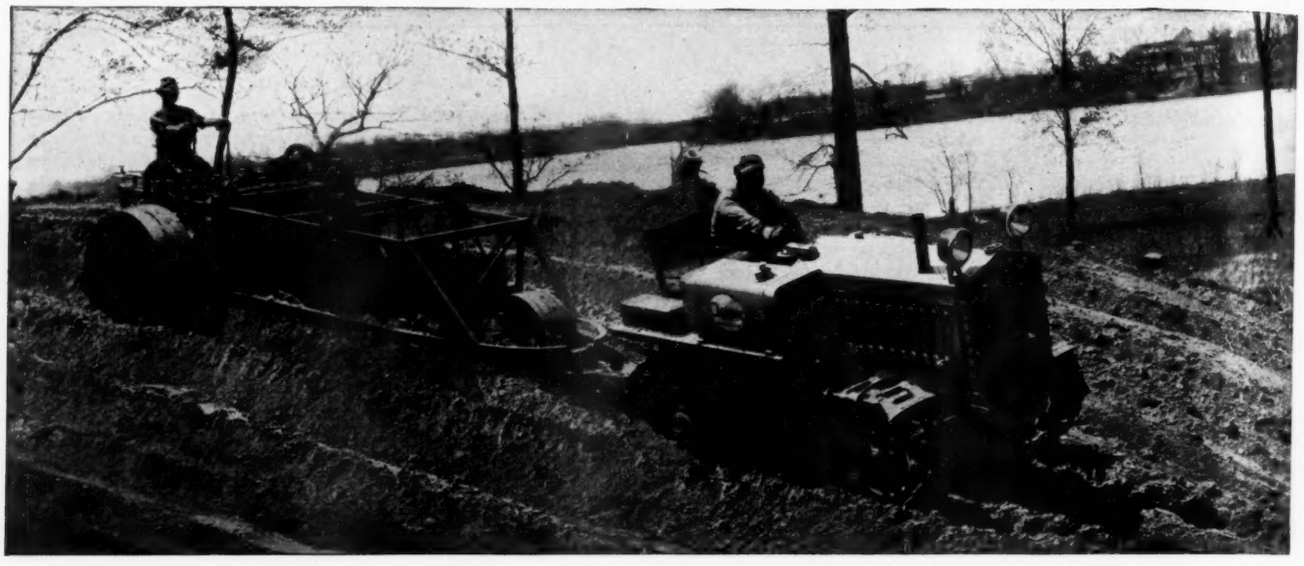

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Vol. 61 July, 1930 No. 7

New Orleans Refuse Disposal Methods

Organization and collection equipment. Five incinerators, distributed throughout the city, eliminate long hauls. Data of incinerator operation. Disadvantages of dumps

THE principal functions of the Division of Public Works of New Orleans are collection and disposal of garbage, ashes and rubbish; cleaning paved streets; grading and improvement of unpaved streets; and activities in connection with bridges, sidewalks, grass cutting, etc. The first named received about 36 per cent of the total expenditures in 1929; the next largest item being 31 per cent for grading and improving unpaved streets; and the third, 22 per cent for cleaning paved streets.

The organization, numbering approximately one thousand men, is effected along functional lines, with a supervisory officer in charge of each class of work. In his report for the year 1929, J. L. Reilly, deputy commissioner, expresses the opinion that, "While this arrangement permits of specialization of the forces, it lacks flexibility to adapt itself to ever-changing conditions, and has the extreme disadvantage of requiring each supervising officer to cover too great an area for adequate supervision. Better supervision probably would be afforded by subdividing the city into a number of districts, each of which would be in charge of a superintendent who would have complete authority over all of the work for which the division is responsible."

From Mr. Reilly's report, the following items of information relative to refuse disposal are selected as probably of interest to other cities.

All household wastes are collected in mixed form. Collections are made daily except Sundays; and even on Sundays refuse from markets and hospitals is collected.

In the collection service there are 4 motor trucks, 3 tractors, 65 trailers, 9 hired carts, and 2 city-owned wagons. Five 10-yard dump trucks are used to remove ashes from the five incinerators. The wagons and carts will eventually be replaced by trailers when the unpaved streets on their routes have been improved to such an extent that the movement of trailers over them for collection of refuse will be practicable. (More than five hundred miles of streets in the city in regular use are still unpaved.) The trailers and trucks are equipped with removable bodies and are unloaded by overhead cranes at the incinerators.

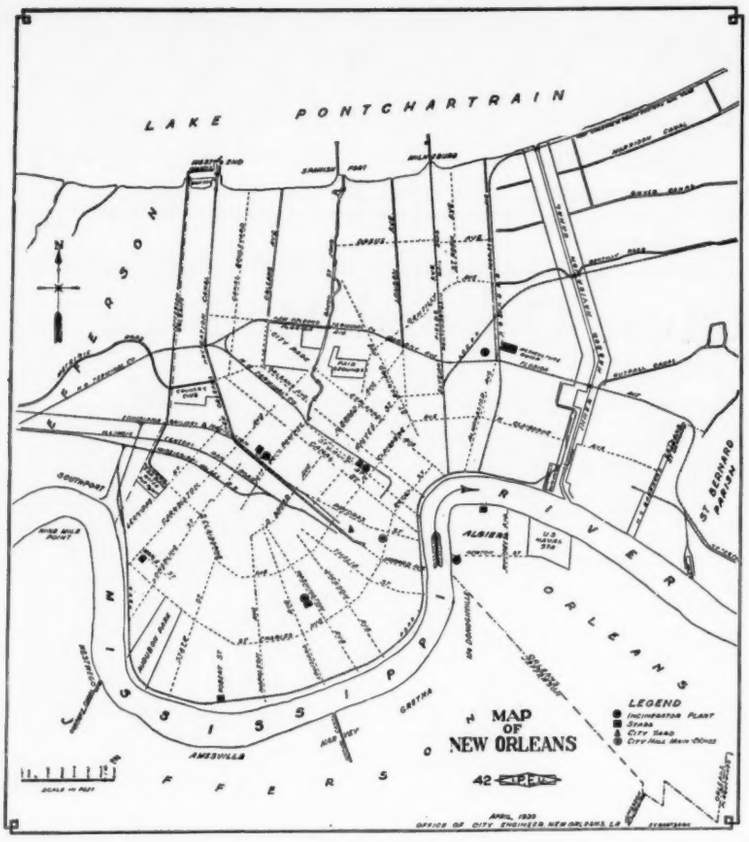
The city has five incinerator plants, three of which were first put into operation during the latter part of 1929. They are so located that, except for fifteen collecting routes, the trailers haul their loads directly to them without the necessity of supplemental transportation.

Except for the refuse collected by the nine hired carts and two city-owned wagons, all other wastes are disposed of at the incinerators. The refuse collected by the carts and wagons is delivered to the one dump still in use. Each incinerator is in charge of a superintendent who has complete charge of its operation.

The incinerators are known by the letters A, B, C, D, and E. A is at Algiers, across the Mississippi from the main city. It was constructed in 1916 at a cost of $32,000. The capacity is 1½ tons per hour, and operation of eight hours a day suffices to consume the garbage of Algiers.

Incinerator D is a Decarie plant, constructed in 1922 at a cost of $138,000, exclusive of site. It has a rated capacity of 110 tons in 16 hours, but has been

Tractor and Train of Trailers, and Garbage Collection Trucks, New Orleans



Map of New Orleans Showing Location of Incinerators, Dump, Stables and Yard.

operated about 20 per cent in excess of this continuously from its installation until October 1929, when the completion of other incinerators permitted shutting it down for repairs.

The three new plants B, C and E, are of the Sterling type and were put into operation during September and October, 1929. Plants B and C, each has a capacity of 150 tons in 16 hours, and E is of 50 tons capacity in 16 hours. The three plants cost, including sites, approximately $780,000.

"The principal need of the garbage service is better cooperation on the part of the public. The general use of water-tight, covered, metal receptacles, draining and wrapping of garbage, and separation of ashes and incombustible refuse are absolutely essential to attain a high order of sanitation in this service. Now that the city has done its part in providing up-to-date collection equipment and modern disposal facilities, it is in a position to set up and enforce regulations which will further improve the service. The present service, which is given every day, costs approximately one-dollar per capita per year, or only one and one half cents per household per day."

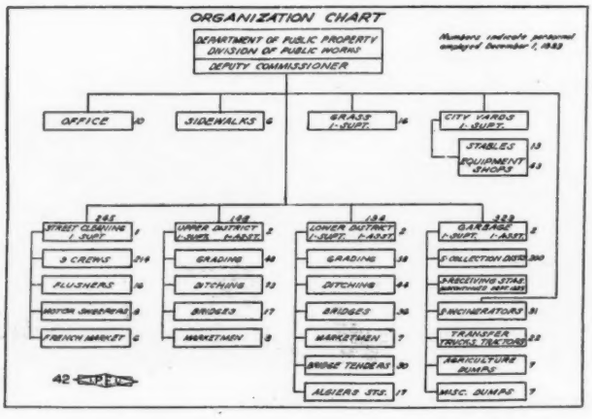
Operation of Incinerators for the Year 1929

INCINERATOR D

Month	Tons Refuse	Purchased Power KWH	Generated Power KWH	COSTS Fuel	Labor	Supplies	Repairs	Total	Cost Per Ton
January	2914.94	2040	1100	$66.51	$2455.23	.....	$35.00	$2829.29	1.02
February	2618.20	1600	2380	86.51	2203.24	.....	35.00	2324.75	.88
March	2851.87	1590	1570	53.14	2525.93	.....	35.00	2614.07	.91
April	2892.70	1730	1200	19.13	2459.17	12.00	28.00	2519.30	.87
May	2914.95	2580	710	121.80	2516.73	.....	28.00	2666.53	.91
June	2473.00	2510	530	142.80	2385.80	.....	35.00	2562.60	1.01
July	2478.94	2910	70	160.65	2580.28	.....	28.00	2768.93	1.12
August	2957.55	2120	830	107.10	2501.23	.....	28.00	2656.33	.89
September	2642.70	1850	1250	64.48	2380.00	.....	35.00	2476.48	.93

INCINERATORS B C AND E

Month	Incinerator	Tons Refuse Consumed	Labor	Fuel	Supplies	Electric Current, Power	Electric Current, Lights	Total	—Cost Per Ton— Burning	Total
October	(B)	2921.9	$3870.13	$167.50	$201.25	$307.00	$56.86	$3602.64	$1.17	$1.58
November	(B)	2938.6	3601.10	153.00	287.66	299.00	56.87	4397.63	1.08	1.50
	(C)	2541.62	3015.95	56.19	.....	266.50	31.82	3370.46	.97	1.33
December	(B)	3208.3	3796.18	5.00	52.59	338.00	63.83	4255.60	1.00	1.33
	(C)	3094.41	3381.83	7.87	15.85	291.00	33.76	3730.31	.82	1.20
	(E)	1312.49	1648.05	.....	.....	105.60	23.32	1776.97	.95	1.30



Organizing of the New Orleans Division of Public Works.

Comparative data for the past four years are given as follows:

	1926	1927	1928	1929
Total garbage (Tons)	105,479	108,452	107,555	107,387
" " Inc. B	.....	.....	.....	9,068
" " Inc. C	.....	.....	.....	5,636
" " Inc. D	39,758	38,563	34,598	24,815
" " Inc. E	.....	.....	.....	1,312
" " Algiers	4,642	4,584	4,388	4,339
Agriculture dump...	15,806	32,563	37,469	33,247
Other dumps	45,279	32,742	31,100	28,634
Cost per Ton—				
Incinerator D	.81	.85	.85	.95

1929 Costs—Per Ton—

	Inc. B	Inc. C	Inc. E
Burning	1.14	1.24	.95
Total	1.26	1.46	1.30

"For more than twenty years, the city has been dumping garbage and all classes of commercial waste on a tract of low land on the outskirts of the city and

(Continued on page 82)

Making the Road Money Go Further—III

The Re-Tread Top

Detailed description of method of construction recommended, with reasons therefor. Cost, and results obtainable

By Geo. E. Martin
Consulting Engineer, General Tarvia Dept., The Barrett Co.

Re-Tread Stone in Place

A TRAFFIC-BOUND surface gets the motorist out of the mud, but into the dust; surface treatments will eliminate the dust but do not add much to the strength of the road. As traffic increases, it may be necessary to increase the bearing power of the road. Until recently there was no economical method for accomplishing this. However, the development of the intermediate type, fittingly named "Re-tread," during the past few years now gives the road official an excellent new top for old roads at little cost.

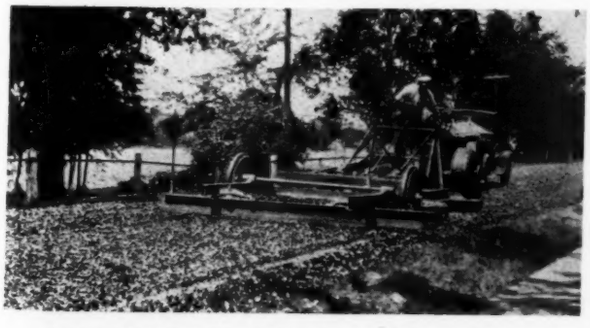
How to Build a Re-Tread Top

Re-tread tops can be used successfully over an old or new road which is strong enough to support the weight of the traffic. Any of the traffic-bound types discussed in previous articles may be used for the foundation. Re-tread tops have also been placed over old rigid-type pavements and on new water-bound macadam foundations.

Applying Tarvia Re-Tread

In preparing the old road surface for a re-tread top, it should be given a prime coat of about one-quarter gallon per square yard of cold refined tar, if it does not already have a bituminous surface. Small irregularities may be disregarded, since they can be taken out with the re-tread top, but major holes or depressions should be patched in the usual manner. If the surface is badly broken, it may be cheaper to scarify it and roll it back into place.

Re-tread is a mixed-in-place combination of aggregate and a special grade of bituminous binder. The operations required are exceedingly simple and no expensive equipment is needed.



Mixing Re-Tread with Maintainer Pulled by a Truck

The steps in the construction are as follows:

1. Preparation of base.—Patch major irregularities in the base; minor ones will be removed by the re-tread top. If the foundation does not already have a bituminous surface, treat it with about a quarter gallon per square yard of cold refined tar.

2. Spread crushed stone or crushed gravel ranging in size from ¾ inch to 1½ inches to an average depth of 21 inches over the prepared base.

3. Apply special re-tread tar at the rate of one-half gallon per square yard.

4. Immediately mix the tar and the aggregate together by means of a blade grader, drag, or maintainer, until the aggregate is as completely coated as possible.

5. Within 48 hours, apply a second coat of special retread tar at the rate of four-tenths gallon per square yard.

6. Resume the mixing operations and continue them until the aggregate is all coated and the tar uniformly distributed through the mass.

7. Keep the surface smooth with the grader, drag or maintainer until the tar begins to set up and the coated stones stick together.

8. Roll once over with a ten-ton, three-wheeled roller.

9. Resume smoothing operations with the grader, drag or maintainer to take out any irregularities produced by the first rolling.

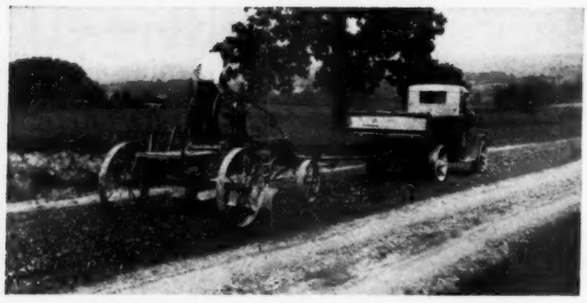
10. Continue rolling operation. During the rolling, sweep in sufficient stone chips, granulated slag or pea gravel to fill the surface voids.

11. Remove any loose material from the surface and seal with one-third gallon per square yard of special re-tread tar or hot surface-treatment tar.

12. Cover with sufficient stone chips, granulated slag or pea gravel to prevent picking up. Drag the cover if necessary to remove minor irregularities, and roll to the final surface.

Why It Is Done That Way

Of course every one of these steps can be varied but we believe they should be carried out as described above and here are the reasons for that belief.



Mixing Re-Tread with Small Grader

1. If the base is very rough, the major depressions should be removed, since otherwise they will be carried up to the surface. The re-tread top will stick to a bituminous surface and if one is not present, it should be provided.

2. The aggregate should be a crushed material, since the strength of the top depends upon the interlocking of the fragments. The size indicated is best for the softer rocks. Very hard aggregate such as trap rock may range in size from one-half inch to one and one-quarter inches. We believe that there is no satisfactory stopping point between a one-sized stone as specified and a scientifically graded mix; and the latter is not practicable for materials mixed on the road.

If larger-sized aggregate is used, the grading and mixing operations are more difficult and there is a natural tendency to slight them, and the re-tread top degenerates into a sort of penetration macadam with few of the advantages of either type.

The depth of stone is sufficient to produce a strong top and not enough to make the cost excessive.

3. A half-gallon at a time is about all the aggregate will hold without running off. Less will not cover the stone.

4. Mixing should be done immediately to obtain the full effect of the tar. A good mixing plan, when using the grader, is to start at the side and windrow the material in the center of the road and then work it out. This is not necessary when using the drag or maintainer.

5. The second application should be made within 48 hours so that the tar coating on the aggregate will not be entirely dry. In summer weather this second application may be of heavier re-tread tar.

6. The second mixing is obviously necessary.

7. If the road is closed, this smoothing operation should not be necessary. If it is under traffic during construction, the smoothing apparatus must be kept operating to prevent ruts from forming in the surface.

8. Tandem rollers and rollers weighing more or less than ten tons may be used, but this type and size seem to give the best average results.

9. This smoothing operation is very important if the base is not smooth, for then there will be a varying depth of the re-tread top which will compact unevenly under the roller. The use of the grader, drag, or maintainer at this point will equalize the high and low spots and produce an easy riding surface.

10. Filling the surface voids will produce a tight top. The sweeping can best be done by means of brooms attached to the roller.

11. Where the job is of sufficient size to justify the use of more than one grade or material, Tarvia-A can be advantageously used for the seal coat in place of Tarvia Re-Tread.

12. Dragging the cover accelerates the drying time of the seal coat and also gives a final smoothing action to the surface.

A Working Plan

A good working plan for an eighteen-foot road is to have at least 2500 linear feet of road covered with re-tread stone before starting. Facilities for hauling and spreading about 2000 linear feet of stone per day should be provided.

First Day—Apply re-tread tar to from 1500 to 2000 linear feet of re-tread stone and start the mixing operations.

Second Day—Apply the second coat of tar on the first section and the first coat of tar on a second section. Proceed with the mixing of both sections.

Third Day—Apply tar on second and third section, and start rolling on first section if it has set up sufficiently. If not, let it cure for another day.

Proceed as above, starting from 1500 to 2000 feet of road as a new working section each day.

The seal coat may be delayed until the entire job is finished.

Results

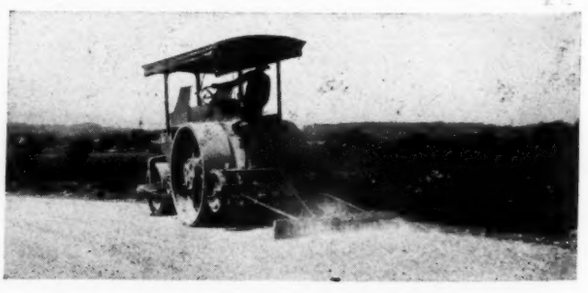
The finished road will have an easy-riding, non-skid surface. Only a small amount of labor is necessary and the equipment required is already owned by most highway organizations.

The smoothing action of this construction is truly remarkable. On one New York macadam road last year, tests were run with the roughometer before and after re-surfacing. (The roughometer measures the up and down motion of an automobile engine block in reference to the front axle of the car. It thus measures the relative roughness of the road surfaces over which the car is driven.) The original macadam road gave almost three times the reading obtained on the new re-tread top.

Costs

Little labor is required, and variations in cost are due to differences in the price of materials. Under normal conditions the work can be done for from forty to sixty cents per square yard—a small price for transforming an old, rough, dusty road into a new, easy riding, non-skid, dustless highway.

These tops are maintained like other macadam with surface treatments. Where the traffic increases enough to cause the road to show signs of distress, it is no trick at all to put on a new re-tread top and make the road as good as new again.



Sweeping Cover Stone During Rolling

Technical Education by Correspondence

Place occupied in the educational system of the country; results claimed for proper use of the advantages it offers; for whom it is of special service

By Samuel Baker

Director, Schools of Civil, Structural and Concrete Engineering, International Correspondence Schools

CORRESPONDENCE instruction occupies today a prominent position in the field of adult education. The annual enrolment for correspondence, or home-study, courses in America alone is about one and one-half millions, or about double the number of students registered in all our resident universities, colleges, and professional schools. In almost every industry, thousands of men and women with little education and but few opportunities in life have been helped by correspondence courses to rise from low position of small remuneration to those of responsibility and good compensation. Some have achieved remarkable success, and have risen to leadership in their chosen occupations or to positions of prominence in engineering. In view of these facts, there is no longer a question of the efficacy of technical education by home-study courses.

Technical instruction by correspondence began in the United States in October, 1891. The State of Pennsylvania had enacted in 1885 a law requiring those who wished to qualify for the position of mine foreman to pass an examination in the theory and practice of coal mining, and other coal-mining states soon passed similar laws. The need for greater safety and economy in coal mining made the passage of these laws necessary, but the ambitious American coal miner was hard put to it to acquire the training essential for promotion. The good texts on coal mining were by British authors and dealt entirely with British practice. Besides, the miners found difficulty in understanding them. As a result, inquiries about mining problems began to pour in to the Correspondence Department of the *Colliery Engineer*, a technical coal-mining periodical, in such large quantities that the management decided to prepare a short correspondence course in Coal Mining to meet American conditions.

The success of this system of education was apparent from the start. In the first six months one thousand students were enrolled. The preparation of other courses dealing with technical and commercial subjects soon followed, and thus developed the present International Correspondence Schools (generally known as the I. C. S.), with its 26 schools and more than 300 courses and an active student body of about 300,000. Other home-study institutions followed the lead of the I. C. S.

Correspondence instruction was brought into use at a time when our industries were rapidly expanding and an increasing demand was created for men trained to fill technical or supervisory positions. Our colleges and universities, adhering to the traditional methods of academic training, were not prepared to meet this growing demand for specialized adult education, and privately-owned correspondence schools offered to employees in engineering offices, business organizations, factories and mills the opportunity, by home study during spare hours, to meet the problems in their chosen occupations and to make the most of their abilities. Industry, also, has been supplied with men who can perform their work in a more intelligent manner.

Correspondence instruction has been found particularly advantageous in training men in the various branches of engineering—not only those without previous engineering experience or education, but also the many who started out in engineering without adequate preparation or who need special training in the problems of their chosen branch. Among the prominent engineers who have received their engineering education entirely by correspondence as I. C. S. students are Frank McManamy, chairman of the Interstate Commerce Commission; Joseph Tynan, vice-president of the Bethlehem Steel Co.; Jesse G. Vincent, vice-president in charge of engineering, of the Packard Motor Car Co.; Edward Rickenbacker, vice-president of the Fokker Aircraft Corporation in America; and Shelby D. Dimmick, vice-president and general manager of the Glen-Alden Coal Co.

Undoubtedly correspondence instruction has come to the fore in the field of adult education mainly because of what it has accomplished for those whose opportunities of acquiring an education were limited. However, a great measure of the success of the well-established home-study institutions is due to the methods developed by them for their particular needs. The instruction material they supply is usually in the form of pamphlets, prepared especially for study without the aid of an instructor. These pamphlets are generally written by men who are specialists in their fields, and their work is carefully edited by writers and editors with long experience in home-study methods of education. Great pains are taken to present the subject in each text clearly and concisely and to provide many problems completely worked out to illustrate the practical applications of the subject. By way of compensating for the fact that many students do not have the opportunity of seeing the devices or structures under discussion, many illustrations and working drawings are introduced to give the student a clear conception of these devices or structures. At the completion of each unit of instruction, the student is required to answer a set of examination questions, designed to test his knowledge of the subject, and to submit his work for correction and criticism by specially trained instructors. Methods have also been devised for aiding the student in his studies, offering him special instruction when needed, and encouraging and prodding him on when his enthusiasm wanes.

(Continued on page 78)

Sewage Disposal Methods at Leipzig*

Settled in sedimentation tanks, effluent chlorinated and sludge dried on land. New type of scraper for removing sludge from tanks, and of chlorine apparatus

Willem Rudolfs

Chief, Department of Sewage Research, New Jersey Agricultural Experiment Station

THE city of Leipsig is located on the Elster river and has a population of 680,000 people. The sewage disposal plant is divided into two parts: Part I consists of four settling basins 30x180 ft. with a settling capacity of 51,000 cu. ft.; and part II has three settling basins 30x240 ft. with a settling capacity of 57,000 cu. ft. The settling basins are straight-walled, flat-bottom, open concrete tanks.

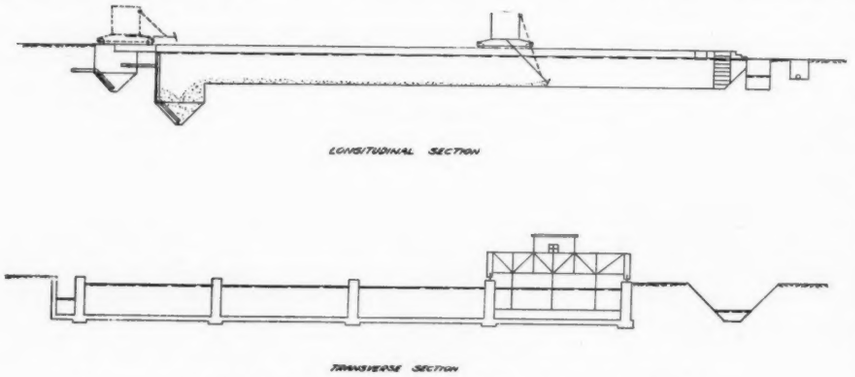
The system of cleaning the tanks consists ordinarily in drawing off the supernatant liquid and removing the sludge by hand labor, pushing the sludge to one end of the tank and flushing the remainder down with a hose. The tanks are cleaned every two weeks with the result that two basins are usually out of operation. This method is still practiced in part II of the plant. In this process a part of the sludge became so thin that it went over into the overflow pipes and discharged into the river; also the sedimentation time is gradually reduced with the filling up of the tanks, resulting in an increased velocity of flow and decrease in the percentage removal of suspended solids. The practice of letting the tanks stand partly filled with sludge for about two or three weeks caused considerable odor nuisance in the summer. In order to produce greater removals and prevent sludge from going over in the overflow, a secondary tank with round ends causing cross currents was constructed and put into service after the three tanks.

The total daily sewage flow is 41 million gallons per day, or 61 gallons daily per capita. The sewage, when received at the plant, is rather old and septic, is black in color and comparatively free from odor. Fresh sludge is intense black and does not have the sickening putrefactive odor attendant to ordinary domestic sewage sludge standing for days in open containers. This sludge, even after standing for eight to ten days, has very little if any odor.

Sludge removal in part I of the plant, consisting of four tanks 6 feet deep, is practiced by mechanical means. The tanks are cleaned mechanically with a scraper traveling the length of the tanks, electrically driven and running on rails. The machine can be moved over to the next tank and utilized for all four tanks. The sludge remover consists essentially of a rubber-lined scraper which can be lowered and driven from a super-structure. The scraper can also be lifted out of the water and moved at a fast or slow rate. The sludge is removed daily and the time required is about one-half hour. If the sludge is removed with a full tank, the supernatant can be drawn off and layers of the sludge pushed out into the receiving sump, which is at the end of the tank and holds about two days of fresh sludge. The sump is emptied by gravity and the sludge expelled to drying areas. The height of the scraper is such that one day's accumulation of sludge can be removed in one movement for the whole length of the tank. This procedure can be practiced in Leipzig because the settled sludge is comparatively dense, but it probably would be difficult with domestic sewage solids of a lower concentration. When the machines are moved, little disturbance of the sludge occurs until near the end of the tank, where some is stirred up and goes out with the overflows. Attached to the scraper is also a grease skimmer which pushes the floating material into a trough at the end of the tank, from which it is discharged into the sludge line.

The advantages claimed for this new machine are substantially as follows: (1) The flat bottom of the tank and the rubber lined scraper allows the removal of all sludge. (2) The sludge is concentrated into a sump since it holds two days of sludge and the supernatant liquid can be drawn off before discharging. (3) Oil and grease is skimmed off and runs separately into a trough. (4) If cleaned daily, no interruption in operation occurs. (5) The removal of sludge takes one-half hour and the rest of the day the settling is quiescent. (6) The construction of apparatus is comparatively simple. (7) If the apparatus is out of order the settling basin can still be used. (8) Sludge can be removed by layers if too much is present. (9) The cost of construction is low due to (a) flat bottom tank, (b) same apparatus can be used for several tanks, (c) daily removal of sludge, therefore increasing the settling capacity of the tank.

* Journal Series paper of the N. J. Agricultural Experiment Station, Dept. of Sewage Research.



Sections of Leipzig Sedimentation Basin, Sludge Sump and Mechanism

(10) The operation costs are low because (a) one laborer can clean in a few hours four tanks 40x180 ft., (b) power consumption is low, about 2 H.P. per tank, (c) depreciation is low, since apparatus works only for a few hours daily.

The Leipzig sewage contains considerable quantities of industrial waste like wool scouring, brewery, dye, iron and gas-house waste. The black color of the sewage is probably due to dyes and iron waste. The daily fresh solids production is 390 cu. yds. The sewage is rather strong, with 300 p.p.m. oxygen consumed.

The sludge from the sedimentation tank is not digested, but is pumped onto land, layer upon layer, and left there to decompose. In spite of the fact that this has been practiced for several years, these open areas do not smell or create nuisances. Some of the old sludge is sold for fertilizer to farmers in the neighborhood. As an average it contains total nitrogen 2.05; P_2O_5, 2.56; K_2O, 0.29, and CaO, 9.92%.

The practice of pumping raw sewage sludge onto open fields certainly can not be practiced with domestic sewage solids in warm climates. Removal of the sludge from the tanks as practiced in Leipzig might possibly be duplicated elsewhere where the sludge is of sufficient concentration, preventing its moving over the top of the scraper and thereby creating a disturbance. If the example of Baltimore is taken, material left in sedimentation basins for eight to ten days results in material which is very acid (pH values as low as 5.1), gives off a disagreeable odor, is difficult to digest, and requires large quantities of lime to bring it into a fair condition for digestion.

The effluent from the Leipzig plant goes into the Elster river, which is already polluted by cities and towns above. To prevent nuisances and reduce the health hazards, the effluent is chlorinated with from 20 to 40 p.p.m. of chlorine, maintaining approximately 0.3 p.p.m. residual chlorine after a detention period of 10 minutes. The tank with round ends built for secondary settling purposes is now used as a detention tank and chlorine mixing basin. With this process of chlorination, the bacterial numbers (37°C) are reduced from 500,000 to 350 per cc. With 26 p.p.m. chlorine, the numbers of bacteria are lower below the sewage outfall than above.

Due to the large quanties of chlorine used, it was necessary to install a considerable number of chlorinators capable of discharging from 12 to 15 pounds of chlorine per day. The new chlorine apparatus recently invented by Dr. Ornstein, which is capable of discharging 250 to 300 pounds of liquid chlorine per day, has done away with the large battery of chlorine apparatus.

Flat-bottom Sedimentation Basin, Leipzig

Electrically Driven Sludge Scraper, Leipzig

This new apparatus is connected with 1½-ton containers filled with chlorine. The cost of chlorination is very high, amounting to 1000 to 1500 marks per day.

There is no doubt that chlorination, which discolors the suspended solids to a grayish yellow color and partially flocs out this material, is helpful in maintaining a better condition in the stream, but the nuisance of possible sludge bank formation is still there.

For reasons of cost and nuisance, experiments are under way with the activated sludge process. The experimental plant is sufficient to purify the sewage of 6600 people with a flow of 265,000 gallons daily. The experimental unit is divided into four parts with four types of aeration, one consisting of four-armed submerged paddle wheels plus air; the second, aeration through filtros plates alone; the third, a drum paddle wheel plus air, and the fourth, a partially submerged paddle wheel alone in a large tank with rounded corners.

With aeration alone, the aeration time necessary is from 6 to 6½ hours, but due to the daily variations in the character of the sewage an aeration time of about 8 hours might be necessary. The amount of air used in tank I in relation to the sewage was 10 to 1. In tank 2, where paddle wheels plus air are used, the relation was 7 to 1. The average results obtained were as follows:

Aver. results in p.p.m.	Influent	Effluent
O_2 consumed (filtered)	220	95
Methylene blue	1 hr.	4 days
H_2S	0.8	0.0
Ammonia	50	40
N_2O_3 N_2O_5	0	0.3
O_2	trace	3.0
B.O.D.	220	30
pH	7.6	7.5
Bacteria (37°C)	1,000,000	30,000
Temperature, °F	60	58

The chlorine used at Leipzig is produced at the factory of the Dye Trust at Bitterfield by the electrolytic process as a by-product. It is placed in 1½-ton containers and conveyed by trucks to the Leipzig sewage disposal plant. The industry sells the chlorine in different types of containers. They are sold in 1½-ton containers at a cost of 24 marks per 100 kilo, ½-ton containers at 35 marks per 100 kilo, and 100-kilogram cylinders at 36 marks per 100 kilo.

The writer is indebted to Dr. F. Mieder, Chief Engineer, for much of the above information and for his cordiality during his visit.

Open Channel of Los Angeles Aqueduct in the High Sierras

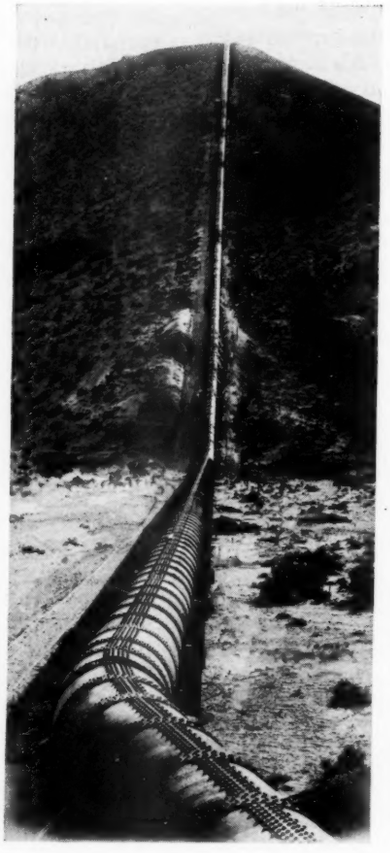
Los Angeles Meets Water Supply Crisis

Votes nearly thirty-nine million in bonds for securing urgently required addition to its supply, tunneling eleven miles through a ridge; building new reservoirs and enlarging old ones; buying two hundred thousand acres, including five towns; and otherwise increasing the capacity of the system

By Robert Newton Clark

THE present supply of water for Los Angeles, Calif., will be taxed to its full capacity in two years, if consumption continues to increase at the present rate. The flow of the Owens river, the present chief source of supply, based on that delivered during the six-year period 1923-1929 (the driest on record), is 336 second-feet, although more than this is available under ordinary conditions. The average consumption in 1929 was 378 second-feet; that in February being about 45 per cent of this, and the maximum, in July, about 191 per cent of it. The surplus winter flow is carried over for summer consumption in storage reservoirs, and the capacity of these also is insufficient for expected increase in consumption.

The city expects to obtain an abundant supply from Boulder dam some time within the next ten or twelve years, but an immediate addition to the present supply which will serve until that time is necessary. This the city plans to obtain by purchasing additional water rights in Owens Valley and developing the full flow of that region, which will suffice until 1936. Meantime, a tunnel will be driven through the divide north of this valley, to divert water into it from the Mono basin, which will furnish a supply adequate until that from Boulder dam is available. Additional storage reservoir capacity also will be provided.



Jawbone Siphon, Los Angeles Aqueduct

The cost of carrying out this program is estimated at $38,800,000, and a bond issue of this amount was authorized on May 20th by a vote of 189,927 for and 22,082 against (unofficial count)—a greater number of votes than has been cast in any previous special election. A committee of citizens financed a campaign in favor of the proposition, working through the Fire and Police Protective League, the Parent Teachers Association, Chamber of Commerce, United Church Brotherhood, and other business and social organizations. Stress was laid upon the fact that the bonds will be revenue producing and the issue carried and retired without cost to the taxpayers, as well as upon the need for additional water.

The diversion of water from Mono Basin requires the construction of collecting works on four streams which now empty into Mono Lake. An open conduit is planned, starting at Leevining creek and intercepting Walker creek and Parker creek. This channel will discharge into Silver lake, which will be enlarged by a dam at its outlet so as to provide adequate storage. From Silver lake a tunnel will be driven through the divide that separates Mono Basin from Long Valley, to convey water into the upper reaches of Owens river. Furthermore, it is proposed to construct a dam in Long Valley, forming a reservoir in which water may be

stored so as to permit proper regulation of the flow in Owens river. This structure will not be necessary until the water from Mono Basin is discharged into the river valley, so work at this point will be delayed until other operations are well under way.

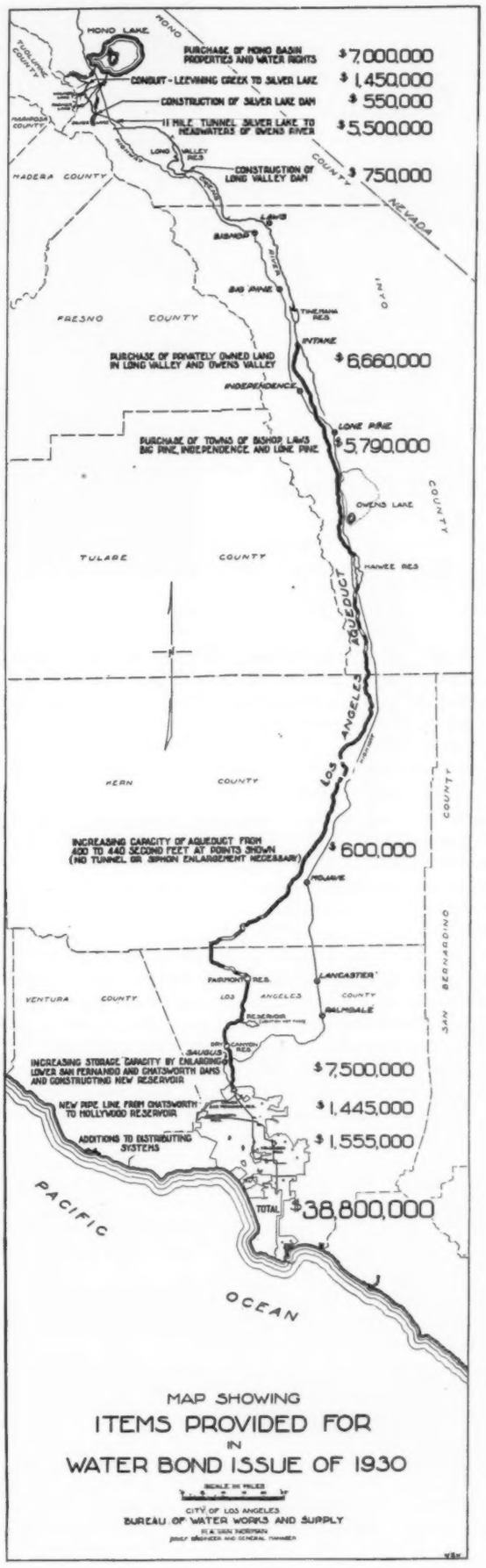
The increase of water in Owens river will be greater than the present aqueduct to the city can carry, so certain alterations will have to be made to accommodate the higher flow. Even with these alterations, the aqueduct will not have quite sufficient capacity to permit full use of the increased supply, but it will be ample for immediate needs. As the demand for water increases, additional storage must be supplied in or near the city to provide for seasonal fluctuations and for emergencies. Also certain changes in the distribution system to accomodate the increase in flow, to cost about $3,000,000, are to be financed from the authorized bond issue.

About half of the money realized from the sale of the present bond issue will be used in purchasing land and water rights. The surface waters in Owens Valley are not sufficient for the needs of the city, so one hundred wells have been driven to draw upon the underground supplies. This made necessary the purchase of considerable areas of land for the sake of obtaining the right to use the subsurface water, but a vast litigation has resulted from the claims of other owners that the city has been impairing their supply of water. As an example of the ramifications of these legal squabbles, suit has been brought against the city of Los Angeles for reparations by certain towns which claim that damage has resulted from the depopulation of certain sections of the valley, consequent to the city's use of water. To settle all disputes, the city has determined to purchase the remaining privately owned lands in Owens and Long Valleys. It is estimated that $5,790,000 will be required to purchase the towns of Bishop, Laws, Big Pine, Independence, and Lone Pine, with a combined area of about 2350 acres; and that $6,660,000 will be necessary to secure other privately owned lands outside of the towns; these figures being those obtained by Los Angeles engineers and appraisers, adjusted by conferences with representatives from the areas affected.

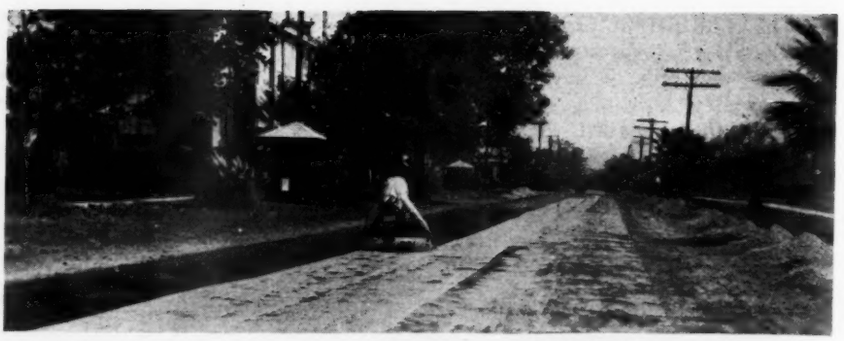
The purchase of the remaining lands in Mono Basin, Long Valley, and Owens Valley will result in many advantages to the city, as it insures not only legal control of water, but also permits close sanitary supervision of the towns and positive adjustment of many irritating problems. It is expected that the land now under cultivation, which represents but a small proportion of the total holdings, will continue to be used under lease, provision having been made in estimating the safe supply for the diversion of water for its irrigation, although the greater share probably will find its way back into underground storage.

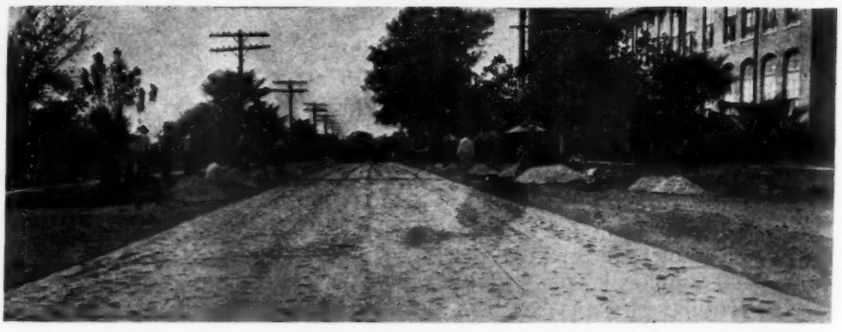
The water collected from the Mono Basin is similar in quality to the water from Owens river. The water shed lies in the high Sierras at an elevation exceeding 7000 feet above sea level, and melting snows are depended upon for a large proportion of the runoff. The natural waters are free from objectionable impurities and are to be turned directly into the distribution system without special treatment. Samples will be collected daily at the city, and chlorination apparatus provided at each point where the water enters the distribution mains.

(Continued on page 74)



Cotton Fabric in Road Construction





Using Cotton Fabric on a Texas Road.

IN 1926 and 1928 the state highway department of South Carolina laid two pieces of experimental road in which cotton fabric was used, to determine what, if any, advantages there might be in the use of this material. The two experimental stretches, one in Newberry County and one in Spartanburg County, totaled about 1¼ miles in length.

The test roads were constructed after the ordinary method of building top-soil roads and giving them bituminous surface treatment. The road having been shaped and thoroughly bonded was thoroughly swept and all loose particles removed. A prime coat of ¼ gallon per square yard of light tar, 8 to 13 specific viscosity, was then applied. After an interval of 24 hours, while the tar was still sticky enough to hold the fabric in place, the cotton fabric was spread longitudinally along either the entire width of the road or along the shoulders only. The fabric used was an open weave weighting 4.61 ounces per square yard and containing 3½ warp threads per inch and 7 filling threads per inch, both yarns four-ply. Approximately .4 of a gallon per square yard of asphaltic oil 150 to 200 penetration was then applied hot (not less than 275 degrees F.) to the fabric and surface, and immediately covered with about 50 pounds per square yard of coarse sand, or sand and fine gravel, or finely crushed limestone or granite. The road was then ready for traffic.

For satisfactory results the surface should be swept thoroughly clean; the tar should not be heated beyond 150° and applied at not less than 125°, and only to a dry surface.

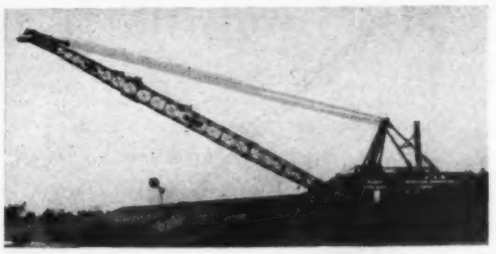
In making the first test road in South Carolina the entire surface was covered with the fabric, but in the second experiment the shoulders only were so covered. The fabric used in Newberry County cost about 40c per pound or 13c per square yard F.O.B. mill, while that used in Spartanburg County cost about 38c per pound or 11c per square yard, F.O.B. mill. The department reports that the experiment has been sufficiently encouraging to warrant continuing experiments along this line. Following the South Carolina experiments, the Texas state highway department is experimenting with this material.

Replying to our inquiry concerning the success of this experiment, State Highway Engineer Chas. H. Moorefield writes: "It is somewhat problematical as to what extent the use of cotton fabric reinforcement increases the life of our usual type of bituminous surface treatment. It seems to reduce the maintenance cost during the first couple of years, particularly that of repairing progressive failures beginning at the outer edges of the treatment, but at a somewhat later stage in the life of such treatments it is often necessary to scarify them and re-treat, and at that particular time the cotton fabric might be of considerable disadvantage unless some change in the ordinary technique of re-treatment is developed. Until our experimental stretches of surface treatment in which cotton fabric was used have passed this stage, I do not believe that we will be warranted in making any very broad statement as to the benefits to be expected from the use of the cotton fabric."

Advocates of this system claim that it gives increased supporting strength under the outer edge of the pavement by preventing rain water soaking in at this point; that it strengthens the resistance of the surface to shear and holds broken pieces in place; that it tends to delay displacement of small pieces of impervious surface treatment on the edges of the road, preventing checker-board cracking when the material has become brittle—a condition often referred to as "elephant-hide," and retards the forming of corrugations by restraining flow or displacement of materials when too large a proportion of bituminous material has been used in the surface treatment, or from traffic continually following one lane.

Grosser Construction Co., at Convent, La., Using Monighan with 3-yard Page Bucket

In Center—Hearin Job; Bucyrus



McWilliams Dredging Co. Using New Marion Steam Dragline, 150-ft. boom, 7-yd. Bucket with 100-ft. Boom and 3½-yard Bucket

Draglines Do Bulk of Levee Work on Lower Mississippi

MUCH levee construction, mainly that required by encroachment of the river on present levees, has been under way in the vicinity of New Orleans. This work is under the direction of Major W. H. Holcombe, who is in charge of the Second District, New Orleans, U. S. Engineer Department. In addition, construction work on the Bonnet Carre spillway is being carried on, and surveys of the Atchafalaya basin are being made to secure more data regarding the floodway.

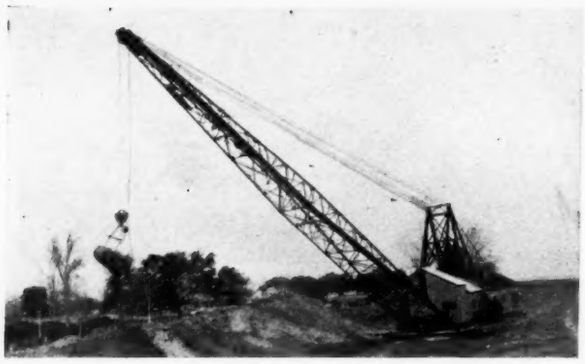
On the east side of the river, between New Orleans and Baton Rouge, are a number of levee construction jobs that illustrate quite well the general methods employed in this district. Near Lutcher, La., Don B. Hearin & Son received a contract for constructing a section of the St. Elmo-Angelino levee. This job involved the placement of 294,000 cubic yards of earthwork, on which the contract price was 13.37 cents. On the job are two Bucyrus steam draglines. A 3½-yard machine, with a 100-foot boom, travels down the river side of the levee to be constructed, throwing up a spoil bank, part of the material for which is obtained from the old levee. The other machine, a track machine with a 5-yard bucket on a 110-foot boom, follows down along the river side toe of the new levee and completes it.

Somewhat above this job the Grasser Construction Co. has a contract to place about 370,000 cubic yards in a new setback levee near Convent, La. The price on this job is 13.83 cents per yard. The contractor has done all the work with a single machine, a 3-yard Monighan with a 100-foot boom, operating a Page bucket. At night, this machine throws up, from material near at hand, the land side section of the levee; and in the daytime completes and finishes the section.

Just above this job, at Willow Grove, the Lewis-Chambers Construction Co. had a contract for building 520,000 yards at a contract price of 21.50 cents per yard. This job was completed some time ago, but on a section of the levee, a slip occurred which necessitated a considerable amount of extra work, including filling in of river side borrow pits in order to counteract the pressure from the levee, which at this point is 22 feet in height. The contractors on this job have used a Bucyrus steam dragline, with a 6-yard bucket and a 150-foot boom.

At Viola, the United States machine B-5, a Bucyrus steam dragline with a 4-yard bucket and a 120-foot boom, received the contract to put up 353,000 yards of levee at 16.74 cents. This machine also had 230,000 yards on the Waterloo section at 20 cents a yard. The plan of construction here was for the dragline to take out a borrow pit, throwing over a muck bank as far as it could reach on the first trip, and then to back-

Where the levee slipped near Willow Grove, La. River shown in right background. Picture taken from new levee which sank, earth rising in middle foreground.



Monighan Walker, 4½-yard bucket on 150-foot boom; C. I. Jones Job

U. S. B.-5 Bucyrus 4-yard steam dragline at Viola, La.

track and on the next trip complete the levee from this muck bank and the additional dirt it can reach from the new location.

Somewhat farther up the river, on the Indian Camp—Southwood levee, C. I. Jones, has had a new Monighan walker at work. This machine can use a 6-yard bucket, but during the past season used a 4½-yard bucket on a 150-foot boom. This contract totaled 2,130,000 cubic yards, on which the bid price was 17.75 cents a yard. Mr. Jones also has had on the job two Monarch 75 tractors, which are used on clearing work, for pulling stumps, hauling logs, etc.

Just below Baton Rouge, the MacWilliams Dredging Co. had a setback levee job, on which they brought in a new Marion Type 5240 steam dragline, with a boom 150 feet long and a 7-yard bucket. In addition to this machine, there was a smaller diesel powered Bucyrus, with a 2-yard bucket and 65-foot boom, which was used to cut the muck trench. Work on this contract was begun late last fall.

Set-Back Lines on County Highways

A state law of Wisconsin provides that the county board of any county "may, by ordinance, regulate and restrict the location of trades and industries and the location of buildings designed for special uses, and establish districts of such number, shape and area, and may also establish set-back lines outside the limits of incorporated villages and cities as such county board may deem best suited to carry out the purposes of this section."

However, before adopting any such ordinance, the board must submit the same to the town boards of the town or towns in which may be situated any lands affected by the ordinance and obtain the approval of any such town boards in so far as the same affects the lands in such towns.

Some counties have established set-back lines along their principal highways, but a very large majority have not, and already in some cases the immediate proper development of some of the principal roads is cramped. The State Highway Commission has called the attention of counties to the matter, saying that it considers that "proper planting along the roadsides, especially of the native trees, and the acquirement of areas along the roadside which may be situated so as to be of recreational value to the public are tremendous assets, not only to the highway itself but to the community in which the highway may lie. Many such areas are of little or no value for any other purpose and yet are of exceedingly great value for recreational purposes."

Bacterial Population and Sludge Digestion

A study of bacterial population during sludge digestion has been made in the laboratory of the Sanitary District of Chicago, and the procedure and conclusions were reported in a paper in the April 1930 issue of the "Journal of Bacteriology" by C. C. Ruchhoft, J. G. Kallas and G. P. Edwards, respectively bacteriologist, assistant bacteriologist and principal assistant chemist of the Sanitary District.

Six sludges were tested—activated sludge, fresh sludge, and mixtures of the two in which 10%, 20%, 33%, and 50% respectively were activated sludge. One series of these mixtures was incubated at 15° C. and another at 25° C. The authors describe at length the methods employed, give the data obtained, with curves showing the trends, and reach conclusions, some of which are as follows.

The greatest reduction of organic solids was found in the mixtures containing 20% activated sludge or less (on the dry organic solids basis), and the least in the activated sludge alone.

After 160 days the reduction in organic solids in activated sludge was 26% at 15° and 41% at 25°, while in the mixture containing 20% activated sludge, the reduction was 46% at 15° and 53% at 25°. (From which is would appear that temperature is much more important in the digestion of activated sludge than in that of fresh sludge.)

In general, the bacterial populations increased for ten to fifteen days until an equilibrium was reached, after which rapid declines set in and continued throughout the practical digestion period. The total bacterial populations were, as a rule, highest in the mixtures having the most fresh solids and lowest in the activated sludge alone.

Assuming that the total bacterial population was responsible for sludge digestion, the flora present in the activated sludge was apparently as efficient in organic solids reduction as the flora of fresh solids.

A comparison of the rates of organic solids reduction per billion bacteria showed that the average rate for one hundred days was 2.2 times as great at 25° C. as at 15° C. for mixtures containing 20% activated sludge or less; and 3.8 times as great for activated sludge alone.

Operation of Glass-Covered Sludge Beds*

Special tests made on two beds at Marion, Ohio, to learn capacity in actual service for the entire year 1929, and conclusions derived therefrom

By Floyd G. Browne
Superintendent and Chemist, Sewage Treatment Works, Marion, Ohio, and
Frank Woodbury Jones
Sanitary Chemist, with George B. Gascoigne, Consulting Engineer, Cleveland, Ohio

AT the 1926 meeting of this Association we presented a paper on the general subject of the air drying of sludge on glass covered sand beds. At that time the total number of glass-covered sludge drying beds in actual service was under 10. At the present time returns from various greenhouse manufacturers indicate that this number has increased to over 80. Furthermore, most of the new construction has taken place since 1928 and, in consequence, actual operating data are still rather limited. The total area covered by the 80 installations for which we have reports aggregates more than 15 acres, the largest installations probably being at Dayton, Ohio, where there is a total covered area of 110,000 square feet, and at the Cleveland Southerly Sewage Treatment Works, recently completed, containing 36,500 square feet.

The fact that several of the greenhouse manufacturers are making special studies toward developing types of structures particularly adaptable to the drying of sludge is direct evidence that the glass-covered sludge bed has become a recognized part in the general scheme of sewage disposal.

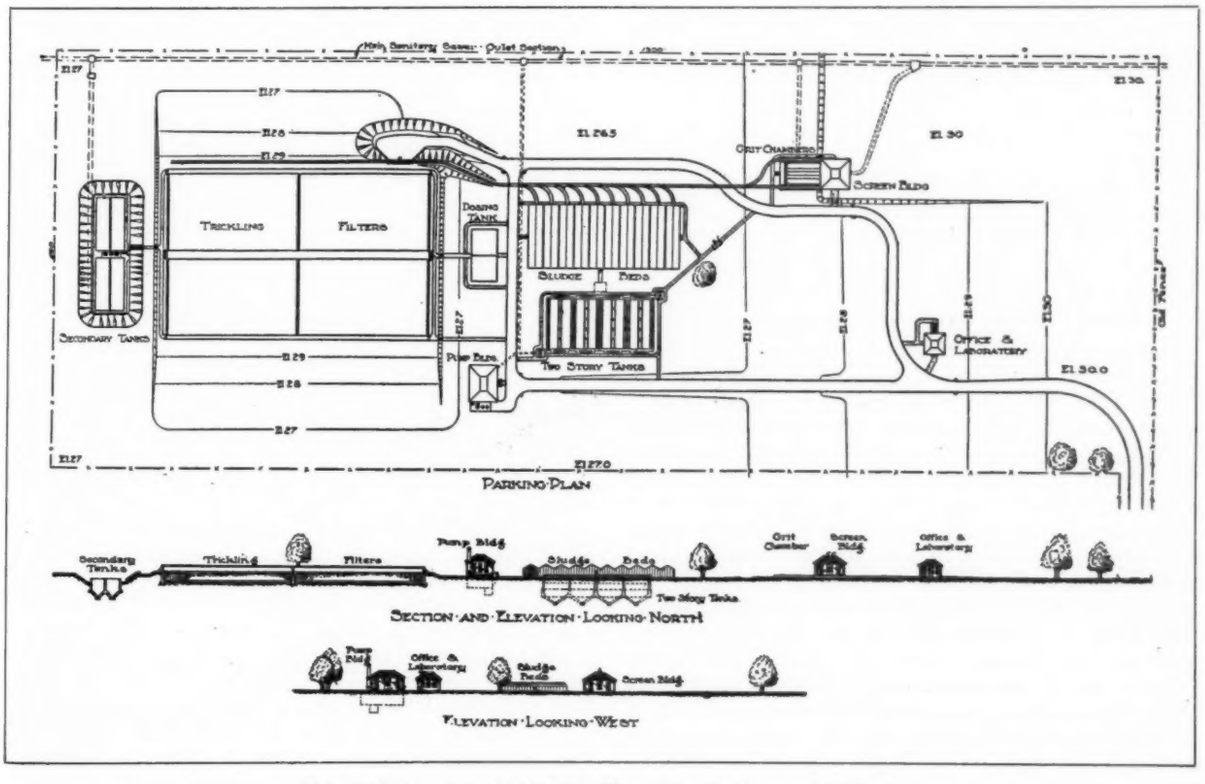
Factors Affecting the Drying of Sludge

Before discussing how sludge may be dried, it is pertinent to state what we mean by sludge drying. Sludge drying is a relative term. We do not expect to get rid of all of the water. When the fluid sludge applied to the bed reaches a condition in which it can be removed from the sand with a close-tined fork without taking too much sand, and without excessive slumping, and in which condition it can be handled and transported readily to the ultimate point of disposal, it may then be regarded for all practical purposes as dried sludge. The time elapsed between the date of application and that of removal may for convenience be called the drying period.

The drying of sludge is accomplished in two general stages, namely, drainage and evaporation. The drainage occurs for the most part during the first two days. Evaporation completes the drying.

Various factors affect both of these. The height of

* Paper before New Jersey Sewage Works Association.



Plan and Sections of Marion, Ohio, Sewage Treatment Plant.

SEWAGE TREATMENT WORKS
MARION, OHIO

IMHOFF TANK SLUDGE DATA

Tank No.____ Bed No.____

WET SLUDGE APPLIED		DRIED SLUDGE REMOVED	
Date Applied		Date Hood	
Time to Pump		Date Removeable	
Temperature, Air ____ Sludge		Date Removed	
Tank Lowered in Inches		Temp. in Greenhouse, Max ____ Min	
Volume by Tank Measurement		No. of Clear Days	
Depth on bed, Max ____ Min ____ Ave		Depth on bed, Max ____ Min ____ Ave	
Volume by Bed Measurement		Volume by Bed Measurement	
Specific Gravity		Shrinkage in Volume	
Weight - Bottle & Sludge	Grams	Loads (1 cu. yd. ea.)	
Weight - Bottle	"	Where Disposed	
Weight - Sludge	"		
Water Equivalent	"		
Specific Gravity			
Weight per cu. yd.		Weight per cu. yd.	
Solids		Solids	
Charge	Grams	Charge	Grams
Weight Residue & Dish	"	Weight Residue & Dish	"
Weight Dish	"	Weight Dish	"
Weight Residue	"	Weight Residue	"
Per cent Solids		Per cent Solids	
Per cent Moisture		Per cent Moisture	
Pounds dry Solids		Pounds dry Solids	
Remarks		Remarks	

Form Used in Recording Sludge Disposal Data.

foundation walls, location of and type of walks, type of ventilators and other construction features have considerable effect on the rate of evaporation. The depth and quality of the sand and type of underdrainage influence the draining. There are divers opinions relative to the proper sizes, grading and depths of sand and gravel which should compose a sludge drying bed. It is not our purpose to discuss these here, but to point out that these factors must be recognized.

It is obvious also that the evaporation is influenced by the humidity and temperature of the atmosphere. To our mind, effective evaporation is far more critical in the drying of sludge than is effective drainage. There is still much to be learned concerning both.

Results Accomplished on Glass-Covered Beds

In our previous paper, we referred to results obtained at Alliance, Ohio, where one of the very first glass-covered beds was installed. We made reference also to the first year's operation at Marion. Realizing, however, that the effective drying of sludge is dependent in large measure upon the quality of wet sludge to be handled and other variable conditions, it was our purpose to secure additional data from installations now in service and to this end we sent out several inquiries.

Unfortunately, we find that very little operating information is available, due to the fact that most of the larger installations where laboratory facilities are available are of too recent construction to afford any data. Consequently, we are again forced to rely upon the experience with which we are most intimately familiar.

It is appreciated that no two sludges are the same in their consistency, moisture content, drainability, and texture. In consequence, results obtained at Marion might not be exactly reproducible at another plant. However, we do believe that these results are indicative of what might be expected in any properly designed glass-covered sludge area where the sludge is well digested and does not have a solids content exceeding 8 per cent.

At this point we would emphasize the necessity for a more complete study of sludge drying so that reliable data from various sources may be available in order to establish just what may be expected from a covered sludge drying bed under a variety of conditions as to construction, weather and quality of sludge.

Experience at Marion

Marion is sewered on the separate system. The sewer grades are flat and, in consequence, the sewage when it reaches the plant in summer is always septic and only for relatively short periods in the year is there any dissolved oxygen present. The treatment plant is of the Imhoff tank-trickling filter type. The plant was placed in operation in July, 1924, and has been in continuous service since that time.

The total suspended solids vary between a maximum of 470 parts per million and a minimum of 109 parts, averaging 227 for the year. The removal effected by the Imhoff tanks averages 60 per cent of the total suspended solids.

Daily samples of the fresh solids as deposited in the Imhoff tanks contain volatile matter varying between 55.9 and 88.7, averaging 75.1 per cent. The above results were obtained in 1929, but are representative. The sludge as removed from the Imhoff tanks had an average volatile content of about 53 per cent. The loss in solids due to digestion approximates 40 per cent.

The sludge drying beds have been used continuously but not by any means to capacity. Two of the beds have been used to store sludge removed from the other beds. While piled up it continues to lose water and when practically bone dry it is ground up in a pulverizer and put up in 100-pound sacks which sell for $1.15. We have no difficulty in disposing of all the ground sludge we can make. Furthermore, the sludge which is not pulverized, except for that used about the plant, is all disposed of to near-by country clubs. In fact, the demand exceeds the supply.

In order to establish definitely what service we might expect from the sludge beds, we decided in 1929 to operate two of them to their maximum capacity, as part of the plant routine. The first sludge drawn in these test dryings was placed on the beds on January 1st, and the last was removed on December 31st, 1929. Each bed was dosed and cleaned 20 times. Except for a short period during painting of the frame work, beds 3 and 4 were used throughout the test.

The minimum depth of application was 7.2 inches and the maximum was 10.8 inches, the average for all applications being about 9.3 inches. The average depth of the dried sludge was 3.6 inches, indicating a shrinkage in volume of approximately 60 per cent. The period of drying varied between a minimum of 6 days and a maximum of 43, averaging nearly 16. The moisture content of the applied sludge averaged 92.9 per cent and that of the removed sludge 67.5 per

(Continued on page 69)

Water Department Maps and Field Records*

Desirability of general map, detail and intersection maps, and other records, and suggestions for preparing same. Locating valves. Filing maps

THE purpose of this paper was to present methods of keeping adequate maps and field records for water works plants in forms available for use outside of the office; and of keeping these records closely up to date.

While most water works men will admit the desirability of this, many years of experience in water waste surveys, including examination of the records of many water works plants, large and small, privately and publicly owned, proves that offices keeping such records are the exception rather than the rule. The author cited illustrations from New York, New Jersey, Illinois, Michigan, and Texas. He also quoted the National Board of Fire Underwriters as finding the same condition quite general.

Taking up the matter of the kinds of maps and records which are desirable, Mr. Wilson stated that the maps should include a general map covering the entire system without much detail, showing the entire system in a diagrammatic form on a small scale; second, detail maps and plans of special structures and of the conduit line; third, complete map of the distribution system; four, sectional maps of the distribution system; and five, large-scale intersection maps showing the valve locations and measurements.

The first general map might easily be on too small a scale to show much detail, and details along the line such as pumping stations, gate houses, dams, reservoirs, or standpipes would then have individual plans of appropriate scale.

The detail plans and maps such as those mentioned above, and maps and profiles of large conduit lines, should be filed; the exact location of every joint being measured and recorded, as well as the location of all specials in the conduit, in many cases. These maps should have scales sufficiently large to give the required information.

The valve location map for field use will be on a still larger scale to allow the measurements to be shown clearly.

The number and kind of maps which may be desirable for a given system will vary with the size of the system and also with the class of data which it is desirable to present. For a small plant, one map on a sufficiently large scale may be all that is required to show the details of the distribution system, including location measurements of valves and even of services; but separate maps for the last are generally desirable.

General Map

A wall map three feet square will cover an area of nine or ten square miles at a scale of 500 feet to the inch, which is generally more than ample for a general map showing mains, valves and hydrants. The scale may be decreased to 1,000 feet to the inch for larger systems, but this is about the minimum practicable for a map of the distribution system and if such a scale would require a map more than three feet square it would be better to divide it into two or more sections.

Because an operator knows nothing about drafting should not keep him from making a map—any kind of map is better than none, if fairly accurate and complete. Even the smallest village usually has some kind of street map available—in the county atlas, perhaps. Some one, a student in the village, perhaps, can be found to make a tracing of the map, from which several prints can be made. Where the plant is of sufficient size to warrant the expense, it may be more satisfactory to have a local surveyor make up a map, or to employ someone in the department capable of obtaining the necessary field data, making maps and keeping the records up to date. In a fair-sized water works in a fast-growing community there will usually be plenty of work along these lines to keep at least one man busy most of the time if the work is properly done.

What should be shown on the map depends to a considerable extent on the purposes for which the map is to be used, and the size of the system; since the larger systems may need maps of several different scales to clearly represent the conditions.

If there are several maps, the smallest-scale map of the distribution system should show all mains, valves and hydrants, as well as the more important service connections, such as factory supplies. It may not be possible to show much detail on such a map, but *non-connected* mains crossing each other should be indicated by a break in the line of one main or a loop of one across the other; or, in some cities, intersections show a blob of ink if the mains are connected, the blob being omitted if not connected. Important intersections, too intricate to be shown in proper detail on the general map, may be circled and an enlarged section giving the details shown on the margin of the map.

The larger-scale sectional maps will naturally show more detail than the general maps. In some cities the scale is large enough so that even the location measurements for the services can be shown. This is not usual although the services themselves may be shown on such a map, without undue confusion. Any information regarding the location of the main, depth of cover, etc., will be of value; and it is often wise to indicate also the location of sewers, electric and telephone conduits, gas mains and other street structures.

Intersection Maps

It is desirable that the valve location or intersection maps be kept to a size convenient for use in outside work, and of a size which will fit some standard loose

(*Continued on page 70*)

* Abstract of a paper before the New York Section of the American Water Works Association by Edgar A. Wilson, chief engineer, the Pitometer Co., New York City.

How Suffolk Treats Its Gravel Streets

By R. H. Brinkley
City Manager, Suffolk, Va.

A GREAT deal has been said and written about the necessity of low-cost road construction for state and county highway systems, but financing of city street construction is one of the most troublesome problems confronting Virginia cities today. It is evident that if high-type paving is employed in all cases, many sections of the cities will be deprived of improvements; therefore it is important that a city balance its program so as to obtain the largest mileage of serviceable streets with the funds available.

This problem confronted us in Suffolk with the extension of our city limits in 1916, when a large mileage of unimproved streets was brought into the city. With limited funds available for construction, it was impossible for a city with a population of 12,000 to consider the construction of expensive types for the residential areas.

Still, there was considerable agitation for improved streets, which came to a head in 1921, with the result that the city started an investigation of the merits of low-cost streets.

During this investigation we learned that it was possible to obtain a very good grade of bank gravel, consisting of about 60 per cent coarse aggregate ranging in size from one and one-half inches down, 30 per cent sand and 10 per cent clay: which compacted tightly and cut very little during the wet seasons, and seemed to be particularly well adapted for bituminous surface treatment.

As a result, in the fall the city council authorized the construction of 10,000 square yards of such streets in one of the main residential sections, sewer, water and gas lines being installed previously.

It was decided to build six-inch reinforced concrete curb and gutters on the streets to be improved.

After the curb and gutters had been built, the streets were graded by hand to a depth of six inches below the finished grade. For the most part this sub-grade was a sandy loam, although on a few streets clay was encountered. Over the sub-grade was spread eight and one-half inches of loose gravel, which was delivered on barges and unloaded by hand into trucks which were backed onto the barges. One cubic yard of gravel covered about four square yards of surface. The surface was compacted by traffic, the loose gravel being machined from time to time.

The gravel was allowed to weather over one season, in the meantime being shaped by means of a heavy road machine. During the spring it was then swept free of all loose material, after which it was given an application of light tar, about one-third gallon per square yard, and covered with about twenty pounds of coarse sand. The tar was poured by hand and spread by means of push brooms.

In the late spring of 1923, due to a slight breaking up of the treated surface, it was deemed advisable to retreat these streets. Wishing to use a considerably heavier bituminous material than that used in 1922 and having no means of applying a hot application except by hand, we decided to use Tarmac CP, a tar cold-patching material, instead of a hot application. This material was spread by hand, applying one-third gallon per square yard, and was covered with thirty pounds of ¾-inch stone chips.

Gravel Street in Suffolk, Va.

These streets proved so satisfactory that in the fall we decided to construct an additional 20,000 square yards. It might be of interest to state that the streets treated in 1923 have never been retreated since and the maintenance on them has been negligible.

In the spring of 1924 we treated the gravel streets constructed the previous year; but decided upon a double surface treatment, using Tarmac P (a cold material with a specific viscosity of 8-13) as a prime coat, applying one-third gallon per square yard. This application was not covered with any aggregate, but allowed to penetrate the gravel surface, which took from one to two days. It was then sealed with one-third gallon of Tarmac A, applied hot by means of heating kettles and hand pouring pots and covered with thirty-five pounds of 1¼-inch to ¼-inch stone chips, after which the treatment was rolled with a five-ton roller.

(*Continued on page 60*)

Draining Salt Marsh From Gas Field Crater

By E. B. Johnson

THE blowing out of a large gas well near Alto, La., formed a crater some 500 feet in diameter and over 50 feet deep. Quantities of salt mud were thrown up by the well, filling a bayou and low area between the well and the village of Alto, and so forming a swamp of over 50 acres. This mud, in many places five feet deep, was so salt that, wherever the top was dry, salt crystallized out and the surface became glaring white. The salt marsh mosquito, *Aedes sollicitans*, appeared in such numbers as to create an intolerable nuisance, unusual at a locality two hundred miles from the ocean.

The density of these mosquitoes in Alto during the daytime can hardly be described. It was necessary to close the school because of the impossibility of teaching or learning, and in screening the school, it was necessary to work in pairs, one man screening while the other waved a newspaper to keep the mosquitoes off.

The situation at night was even worse. One of the large property owners who had a well-screened home, gave the following formula for getting any sleep: "About 7 o'clock spray a pint of Flit around the house after closing doors and windows tight; go off for an hour's ride; come back, sweep up the dead mosquitoes, open doors and windows and turn on the fans and get to bed quick; by 2 o'clock enough mosquitoes have found their way through the screens so that sleeping for that night is over." After such treatment, this man never failed to sweep up at least a pint of dead mosquitoes!

As a temporary measure, considerable screening was done. It worked in such places as the schoolhouse, where there were no people at night, but in the houses mosquitoes still got in, their ingress being slowed up but not prevented.

An inspection of the swamp showed that from 50 to 100 acres remained wet, according to the time of the year and the rainfall. The surface where no water stood became hard, but this solidity was less than six inches deep and underneath was quagmire. The surface in such places cracked up like small tile, and breeding was heavy in the cracks, which extended down to water. The soft base underneath prevented the use of any heavy machinery, and when an attempt was made to use mules and scrapers to ditch through the middle, the mules at once became mired up and were unable to work.

A survy showed that the middle of the swamp, where the old bayou formerly ran, was not the lowest part of the swamp. While the whole was very nearly level, the consistency of the mud as thrown out of the crater was such that the actual low part was within twenty feet of the limit of the mud furthest from the crater. Here it was possible, although difficult, to work mules; but the mud was heavy, gummy, and very slippery, and the mules could not work effectively; also the scrapers would not bite into the mud, and is was necessary to break this up beforehand with a deep plow. Even then, the scrapers would ride over the plowed mud and take less than an inch between plowings.

It was then found that the round-bottom ditch made by this method, and usually called for by engineering practice in soils of this type, would not stand up. An apparent upward thrust from the bottom coupled with sloughing from the sides would raise the bottom at the rate of as much as an inch a day.

In the meantime it was found that men could stand up and work in the mud better than mules, and in this way the old bayou be ditched out. Sharp-pointed spades were necessary to enable the men, by riding on the spade, to force it into the mud; but the gummy mud could not be thrown off the spades, and the best plan was found to be jumping out of the ditch after getting a shovelful and removing the mud from the spade with the foot.

As the round-bottom ditch had failed, a straight-sided ditch, about eighteen inches wide and from one to five feet deep was tried. The ditch of this shape has now been in service for eight months, through an extremely wet season, and is in practically as good

Views of Ditch Through Swamp. Note Opening Through Spoil Banks at Side. Where Horse Stands There Was Formerly Five Feet of Salt Mud Under Water.

condition now as when constructed, and merely needs to have a little debris and floatage removed. There apparently has been no upward thrust from the bottom and no sloughing from the sides. The small section which was dug with mules and scrapers is now almost filled up, and will have to be redug. The fall obtained was 12 inches per mile.

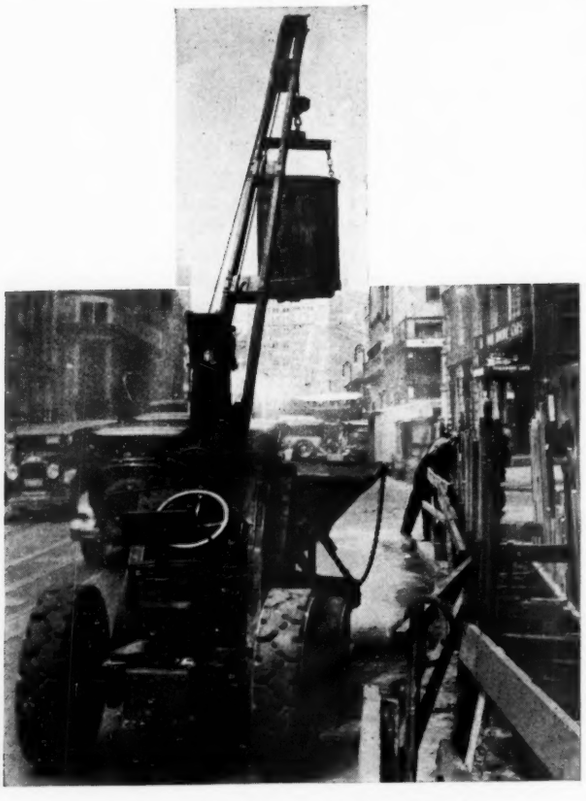
This work was done by the gas company with one of their regular crews and no detailed cost records kept, but the cost was probably around $0.50 per linear foot for the hand-dug ditch and about twice as much for the mule-and-scraper dug ditch.

Salt marsh mosquitoes are now appearing in other gas and oil fields even farther inland than this.

Sewer Trenching on Heavy-Traffic Streets

IN building sewers on and in the vicinity of Broadway between Times Square and Columbus Circle, New York City, where traffic is intense, it was necessary to interfere with that traffic as little as possible; certainly not to close the street entirely. In the lower part of Manhattan Island machine excavators are impracticable because of the network of pipes below the surface, and hand shoveling is necessary. But the dirt from the trench, fifteen feet deep, could not be piled on the street, especially on Broadway, where there is a double-track street railway. The dirt must be immediately removed and, preferably, used for backfilling the trench; and the trench should be kept as narrow as possible.

In work of this kind recently performed, a travelling crane was used, handling the earth in buckets which were lowered into the trench, filled, and raised by a swinging boom; the crane then travelled close to the trench, carrying the bucket of dirt about 100 feet to the rear, where it was dumped onto the finished sewer. The crane then returned to the head of the trench, lowered the empty bucket and raised a full one, repeating the operation continually.



Crane Carrying Bucket of Dirt on Broadway.

Three hinged-bottom buckets, each of ten cubic feet capacity, were used for each crane, and thirty buckets an hour were removed under average excavating conditions. "Staging out" the dirt by means of platforms was unnecessary, permitting a minimum width of trench. The crane, a Frederic H. Poor "Loadmaster," was 65 inches wide, and occupied only this width of roadway as it carried the bucket directly in front or rear while travelling.

Operated in this way, the sewer construction on the east side of Broadway required north-bound traffic to deviate only a few feet into the roadway, while the street cars and south-bound traffic were not affected. In the side streets the sewer was laid in the center, and one side of the roadway was at all times entirely clear for traffic. The cranes were also used for drawing sheeting and handling pipe.

Sewage Treatment at Munich

IN a description of this plant, designed for a flow of 82 million gallons a day, by H. Keppner, several points were brought out that are worth special mention.

One of the special features of the plant is the use of large single units, which have proved to be more econmical than a multiplication of small plants. The two-story tanks are quite deep, and danger that they might be lifted or floated by ground water when emptied for any purpose is met by providing pump wells by which the ground water can be lowered.

The sludge is drawn onto sand beds in summer and removed by a power shovel and deposited on fields. In winter the wet sludge is deposited on the fields. One third of the available field area is covered each year, as it is found that in three years the sludge has been practically consumed and the ground can be used again. In removing the dried sludge from the sand beds, a very thin layer of sludge is left on the bed, which avoids the necessity of frequent renewal of the sand.

Experiments have shown that gas production varies with the temperature; that sludge which has been completely degasified dries badly; that digestion is better in tanks covered for gas production than in uncovered tanks; and that 20.6 litres (5.44 gallons) of gas per capita of tributary population per day can be obtained by complete digestion at a temperature of 26 degrees C. (or 79 degrees F.).

Water Mains in Hartford, Conn.

In the table in our June issue giving the amount of cast-iron pipe laid in 1929, the figures for Hartford, Conn., indicate that that city last year laid 19,448 feet of mains under 6 inches diameter, and 57,492 feet of 6 to 12-inch pipe. We are informed by the chief engineer of the Water Commission that the city laid no pipes smaller than 6-inch, but that the 19,448 feet was 6-inch pipe, and that the 57,492 feet applied to 8-inch to 12-inch pipe.

THE EDITOR'S PAGE

Speed and Surface Smoothness in Pavement Construction

Every year we find contractors breaking the previous year's record in speed of laying concrete pavements. Is there danger that they are sacrificing quality for speed?

The proportioning of the aggregates, if done by proper measuring equipment, will not vary, no matter how rapidly the trucks be filled. If measuring equipment be not used, the proportions probably will not be uniform, no matter what the speed. Speed in transporting aggregates from bin to mixer can not conceivably affect the quality of the concrete. The duration and speed of mixing continue constant at specification requirements if the inspector is doing his duty. Apparently the only operation in which speed could affect any quality of the pavement is in the finishing. But if this is done by machine, much of the possibility of slighting it is eliminated; although it may be done too soon after laying for securing the best results, or may not be satisfactorily protected against drying out. It may be said that speed is obtained not by hurrying up any of the several successive processes, but by eliminating delays between processes.

That smoothness of surface is not inconsistent with speed of construction is indicated by the results obtained in last year's highway construction on California's state highways. In fact, as stated in the article on page 56, the contractors who made the best speed records produced the smoothest pavements, and the pavements laid by those who had the lowest records for speed gave the poorest roughometer records. This variation was so consistent throughout the record that it indicates a relationship between the two. We believe this relationship can be expressed generally by the statement that both speed of construction and good workmanship are the results of experience, skill and close attention to details.

It follows that it is to the advantage of state highway officials not to give work to contractors who can not attain fairly good speed. In an article to appear next month we will tell how Pennsylvania is devoting considerable attention to teaching its highway contractors how to increase their speed without sacrificing quality. This should result in both bigger profits for the contractor and lower cost for the highway department.

Another reason or two for giving work only to contractors prequalified by a record rather than by a bond.

Road Builders Wish Distributed Lettings

The Executive Committee of the American Association of State Highway Officials on May 26th adopted a resolution in which it was stated that "highway departments favor using their influence to dissipate peaks of contract lettings, so that they may be distributed throughout the year, not only in the interest of labor but also for the more satisfactory distribution of materials and the purchase of equipment necessary for the work."

Quarries, gravel plants, machinery manufacturers and others can and should run winter as well as summer; and they could do so to much better advantage if they knew this fall what next year's requirements would be. It is therefore with good reason that the Manufacturers' Division of the Road Builders Association, the Sand and Gravel Association, Crushed Stone Association and Associated General Contractors all are backing a campaign to this end.

Bidding on Reservoirs at Inaccessible Sites

A contractor bidding on the construction of a reservoir or other structure well removed from inhabited areas must bear in mind a number of considerations in addition to those attached to construction projects not so located. These include the accessibility of the site, the condition of the roads over which it will be necessary to bring his equipment and supplies, and the distance from the railroad freight station or siding; whether there are available the raw materials such as lumber, gravel, sand, water, etc., which will be needed or at least useful; the climate and weather conditions—frequency and intensity of rain and snow fall, duration and intensity of cold weather; probability of floods in streams at the job and their effect on the work; effect of labor unions and state laws—whether or not union labor must be used or the state will enforce a fixed scale of wages; distance of the job from labor centers.

Each of these may have a considerable effect upon the cost, and adverse conditions under all the above heads may well cause the work to cost two or more times as much as if they were favorable. In some reservoir construction the transporting of cement from railroad to job has cost twice as much as the charge for the cement delivered at the siding. Work done during bitterly cold weather and short days of winter costs much more than summer work, if, indeed, sufficient men can be kept on the job at all.

The matter of roads might well be considered by the engineer, to the advantage of his clients and the contractor also. If, as soon as the construction of a dam is definitely decided upon at a site not accessible by road, the city or other party proposing to build it should open up a road to the site from the nearest railroad or highway, giving it a grade which is practicable for trucking, there would not be in the minds of prospective bidders the uncertainty as to accessibility of the site which is suggested to them when they make an inspection trip over a roundabout, rough lumber road followed by a mile or two on foot over a mountain trail in order to reach it. And such uncertainty as to the length, nature and cost of the necessary road to the job will be reflected in the bids. Moreover, the road must be built before the contractor can start work, and having it built beforehand may advance by weeks or months the date of completion of the job. Moreover, the road will probably be used permanently by the city or other owners for reaching the reservoir after its completion, and it may be desirable for them to fix its location just where it will be most suitable for this.

Refuse Disposal at Flint

DURING the fiscal year of 1929-1930 the garbage or Waste Food Collection Division of Flint, Michigan, hauled over 21,000 tons of garbage to a hog farm. The garbage was collected twice a week from more than 34,000 homes and daily from 275 stores and restaurants. This gave an average collection of 0.84 of a pound per capita per day.

The cost of collection was approximately $83,000, equivalent to $3.90 per ton or 2¼c per stop. The cost of hauling to the farm was slightly less than $19,000, equivalent to 88c per ton, or 7 1/3c per ton-mile.

The cost of operating the hog farm was $22,000, which was slightly more than offset by the profit from the sale of hogs. This profit was less than during the previous year because of the very hot, dry weather. The hogs are in the open, and the dust caused throat and lung trouble; an evidence of the responsibility of the dust for this condition being that, within less than a week after the first heavy rain, the losses dropped from an excessive figure to less than normal.

A feeding barn was constructed during the summer and placed into service late in the fall. This permits feeding throughout the entire winter entirely on platforms and under shelter. Also it will permit apportioning the amount of garbage and regulating the feeding times much more accurately than has been possible before, and also will make it possible to keep the farm in an absolutely sanitary condition, because all the refuse can be hauled away and the concrete floor thoroughly flushed off. The refuse removed can then be placed just where it is desired on the farm as a fertilizer; although the farmers in the vicinity are apparently anxious to obtain the material for their own land, after seeing what has been accomplished on the sandy land of which the hog farm originally consisted.

Col. Rich of the State Health Department has stated that the feeding platform will undoubtedly save its cost in a very few years in lessening the feeding losses. Early this spring, when H. C. McClure, city engineer of Flint, wrote his report (from which this information is obtained), the losses had been only 20 per cent as great as those during a similar period of the previous year. It was proposed to obtain a large refuse truck, and possibly a small belt conveyor loader to eliminate much of the shovelling from the feeding platform.

During the year between seven and eight thousand hogs were handled and their total weight was increased over 555,000 pounds. They were sold without difficulty on either the Detroit or Buffalo open market, and to serum concerns which required garbage-fed animals for the development of their hog serums.

The tin can and rubbish collection amounted to an average of 28 4-yard truck loads daily, totaling about 9,000 during the year, collected from about 34,000 homes at a cost of $33,000, or less than $1.00 per year for each house served, or between 5 and 6 cents for each collection. Practically all of the material was dumped along the river bank at a point where a fill is being made, but the available space here will be used up about the middle of this summer.

During the fall of 1929 and the spring of 1930 over 10,000 cubic yards of ashes were collected at a cost of approximately $7,300, or between 6 and 7 cents for each collection, or 71½ cents per cubic yard. The ashes were hauled to dumps or other low spots, a great deal being used for filling clay streets when the ashes seemed to be free from objectionable material.

During the year more than 6,000 small dead animals were collected and buried in an isolated part of the hog farm and covered with lye.

Fees for Street Opening in Pittsburgh

Fees charged public utilities, corporations and individuals for opening streets in Pittsburgh, Pa., have been increased by the city council with a view to further discouraging cutting into pavements. Where the pavement has a concrete foundation the fee is increased from $11 to $15; while if it is of gravel the fee is $5 instead of $4 as before.

Gasoline Taxes and Automobile Taxes and License Fees.

Based on rates in effect January 1, 1930, and arranged according to amount of total fees collected, the table below sets forth the average motor vehicle tax and fee burden in each state. This average includes the gasoline tax, the license tax and the personal property tax. These figures are based on a survey made by Roy Conway of the Oregon State Motor Association and C. C. Chapman of the Oregon Voter, and published by the Research Department of the American Automobile Association.

STATE	Gasoline Tax Cents	Gasoline Tax Average	Reg. and License Fees Average	Prop. Tax Average	Total Average
Nevada	4	$19.40	$ 9.10	$52.28	$80.78
Florida	6	38.03	13.98	10.00	62.01
Georgia	6	37.86	12.67	6.90	57.43
Tennessee	5	27.54	12.62	9.30	49.46
Louisiana	4	25.58	16.59	6.64	48.81
Rhole Island	2	9.41	18.09	20.00	47.50
Texas	4	29.28	14.58	3.28	47.14
South Carolina	6	30.46	11.26	5.00	46.72
Arkansas	5	25.04	17.62	4.00	46.66
Mississippi	5	22.59	11.43	12.41	46.43
Kentucky	5	22.16	15.53	8.40	46.09
New Mexico	5	27.94	9.55	8.50	45.99
Alabama	4	24.11	12.50	7.80	44.81
Maine	4	18.50	16.00	10.18	44.68
Virginia	5	23.89	15.46	5.00	44.35
Connecticut	2	11.20	23.81	9.29	44.30
Washington	3	15.66	17.45	10.87	43.98
North Carolina	5	26.33	13.11	3.38	42.82
Oregon	4	21.50	20.50	None	42.00
Vermont	4	17.30	24.25	None	41.55
Wyoming	4	22.25	10.16	9.10	41.51
West Virginia	4	17.10	16.47	7.47	41.04
New Hampshire	4	18.40	20.20	None	38.60
Ohio	4	20.09	7.18	10.40	37.67
California	3	16.43	5.16	15.00	36.59
Arizona	4	21.40	6.00	8.80	36.20
Maryland	4	19.02	10.64	6.25	35.91
Montana	5	22.40	10.30	3.00	35.70
Illinois	3	15.00	10.32	9.37	34.69
Pennsylvania	4	17.80	16.51	None	34.31
Nebraska	4	20.07	10.10	3.98	34.15
Colorado	4	18.27	6.28	9.36	33.91
Delaware	3	15.63	18.14	None	33.77
Idaho	4*	17.42	15.04	None	32.46
Oklahoma	4	20.38	11.81	None	32.19
South Dakota	4	16.50	15.16	None	31.66
Utah	3½	16.89	7.42	7.25	31.56
Michigan	3	14.68	16.06	None	30.74
Missouri	2	9.75	12.30	8.60	30.65
Indiana	4	18.10	6.98	5.24	30.32
Kansas	3	15.11	10.10	5.16	30.37
Wisconsin	2	9.24	14.52	6.15	29.91
New Jersey	2	11.16	17.89	None	29.05
Massachusetts	2	11.20	5.75	11.33†	28.28
Minnesota	3	12.84	15.00	None	27.84
New York	2	11.20	16.46	None	27.66
Iowa	3	11.64	14.58	None	26.22
North Dakota	3	9.53§	10.56	None	§20.69
Dist. of Columbia.	2	9.98	3.75	3.75	17.48
Average—Totals divided by 49	3.77	19.05	13.21	6.60	38.86

*On March 1st Idaho's 5c gas tax went into effect.

†Massachusetts—$11.33 represents average collections during 1929 on Motor Vehicle Excise Tax, which replaces property tax, but which is levied in addition to the license fee.

§North Dakota—$9.53 represents Gas Tax per vehicle after deduction of Gas Taxes refunded to taxpayers.

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AIR CONTAINER
revolutionizes truck tire performance

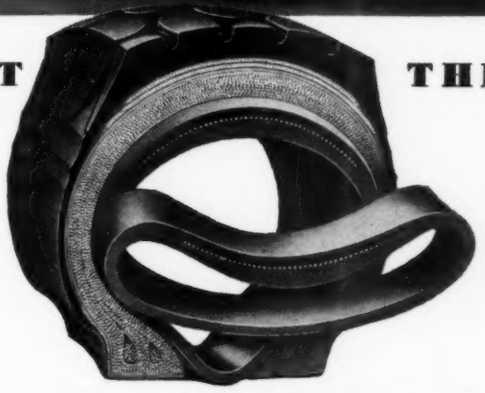
...seals punctures, adds 25% to 35% more mileage to the tire...ends ALL road delays.

FREEDOM from punctures, flats, road delays . . . more mileage for the tire . . . less service worries as to inflation, inspections . . . absolute safety under every condition of speed, power load . . . and, with it all, decidedly lower truck tire costs—these are the principal reasons why large fleet owners, as well as individual operators, are looking upon the Goodrich Air Container as the greatest single development since the balloon tire.

The fleet shown below is an example. These 13 new trucks operated by the Coca Cola Bottling Co., Kansas City, Missouri, are all equipped with Goodrich Heavy Duty Balloons and Air Containers. At present their entire fleet is now Goodrich 100%—Economy and added efficiency are the answer. Let the nearest Goodrich Distributor demonstrate this combination to you.

The B. F. Goodrich Rubber Co., Established 1870, Akron, Ohio. Pacific Goodrich Rubber Co., Los Angeles, Calif. In Canada: Canadian Goodrich Co., Kitchener, Ont.

FACTS ABOUT THE AIR CONTAINER



1. Maintains uniform air pressure
2. Seals punctures on running wheels
3. Increases mileage 25% to 35%
4. Eliminates costly repairs and road delays
5. Gives inside support to casing
6. Performs for life of truck
7. Reduces tire care to minimum

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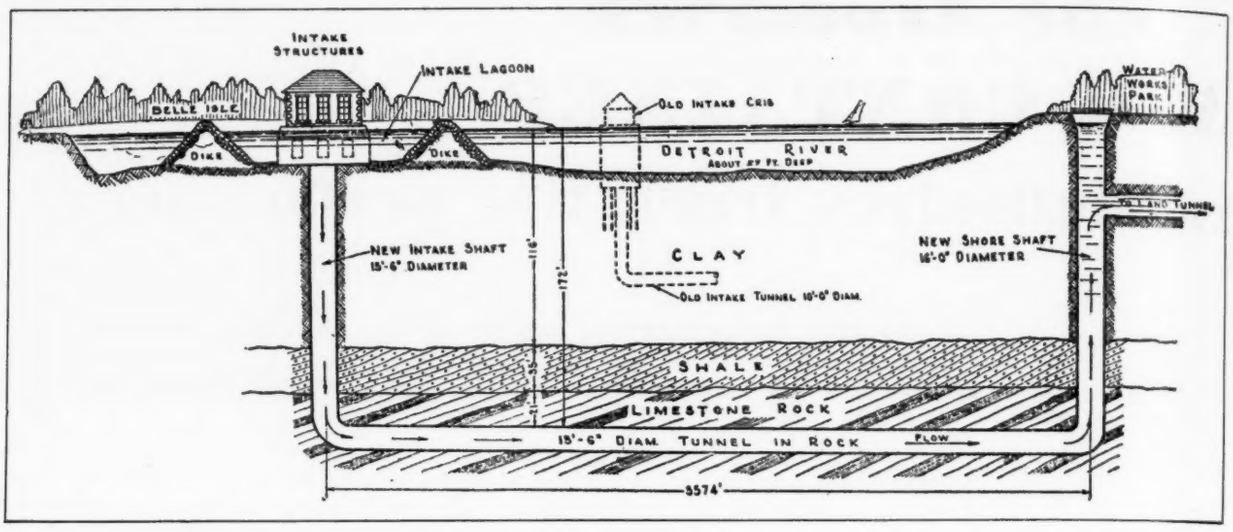


Detroit's New Water Intake

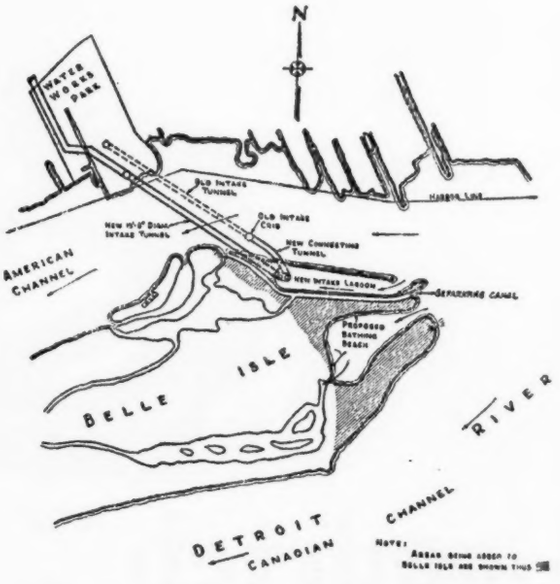
THE new pumping station being built at Detroit, Mich., known as the Springwells pumping station, was described in the May issue of PUBLIC WORKS. As stated therein, the new station receives its supply from a new intake in the Detroit river at the upstream or eastern end of Belle Isle. In addition to a desire to practically double the supply for the city, the new intake was decided upon with a view to eliminating, or at least minimizing, trouble from ice which has frequently occurred at the old intake.

The new intake is located where the water is at present only 8 feet deep. After the shaft has been completed the site will be dredged, forming a lagoon extending into the river for about 3,000 feet east from the present land area of Belle Isle, the excavated material being used to construct dikes along the two sides of the lagoon; which dikes will later be paved with rock taken from the tunnel being driven to connect the intake with the pumping plant. The eastern ends of these dikes are so constructed that ice moving in the river will pass by the lagoon and not enter it.

In addition to building the dikes, material dredged from the lagoon will be used for adding a considerable area to the eastern end of Belle Isle, which is used as a park and pleasure resort for Detroit; another lagoon being formed between two parts of the fill which will be used as a bathing beach. The entrance to the bathing beach lagoon and that to the intake lagoon are near together and it would of course be undesirable to have water from the former enter the latter. To prevent this, it is proposed to maintain the water in the bathing beach lagoon a little below that in the river outside by means of pumps which will continually draw water from the bathing beach lagoon and discharge it into the Canadian channel of the river, which is on the opposite side of the lagoon from the intake lagoon.

The intake shaft is being sunk by means of a cofferdam built of heavy steel piling driven 60 feet into the clay. About 120 feet down, the shaft will strike rock, and will be continued about 80 feet through the rock to a total depth of about 200 feet.

Meantime, a shaft has been sunk near the pumping station in Water Works Park to a depth of 200 feet. This shaft was built of concrete above ground and sunk by excavating within and below the walls of it. When the shaft had settled down to the rock, the joint between it and the rock was sealed with concrete and the shaft continued through the rock by blasting. The shaft passed through 20 feet of fossilized shale and 60 feet of dense limestone; and from the bottom of this shaft a 15-foot 6-inch tunnel was started toward the intake shaft, 3,574 feet away. From the shore shaft another tunnel at a higher elevation is carried under the city streets for a distance of nearly ten miles to the Springwells pumping station and filtration plant in the western part of the city. It is planned in the future to locate a third pumping station and filtration plant in the northeast section.



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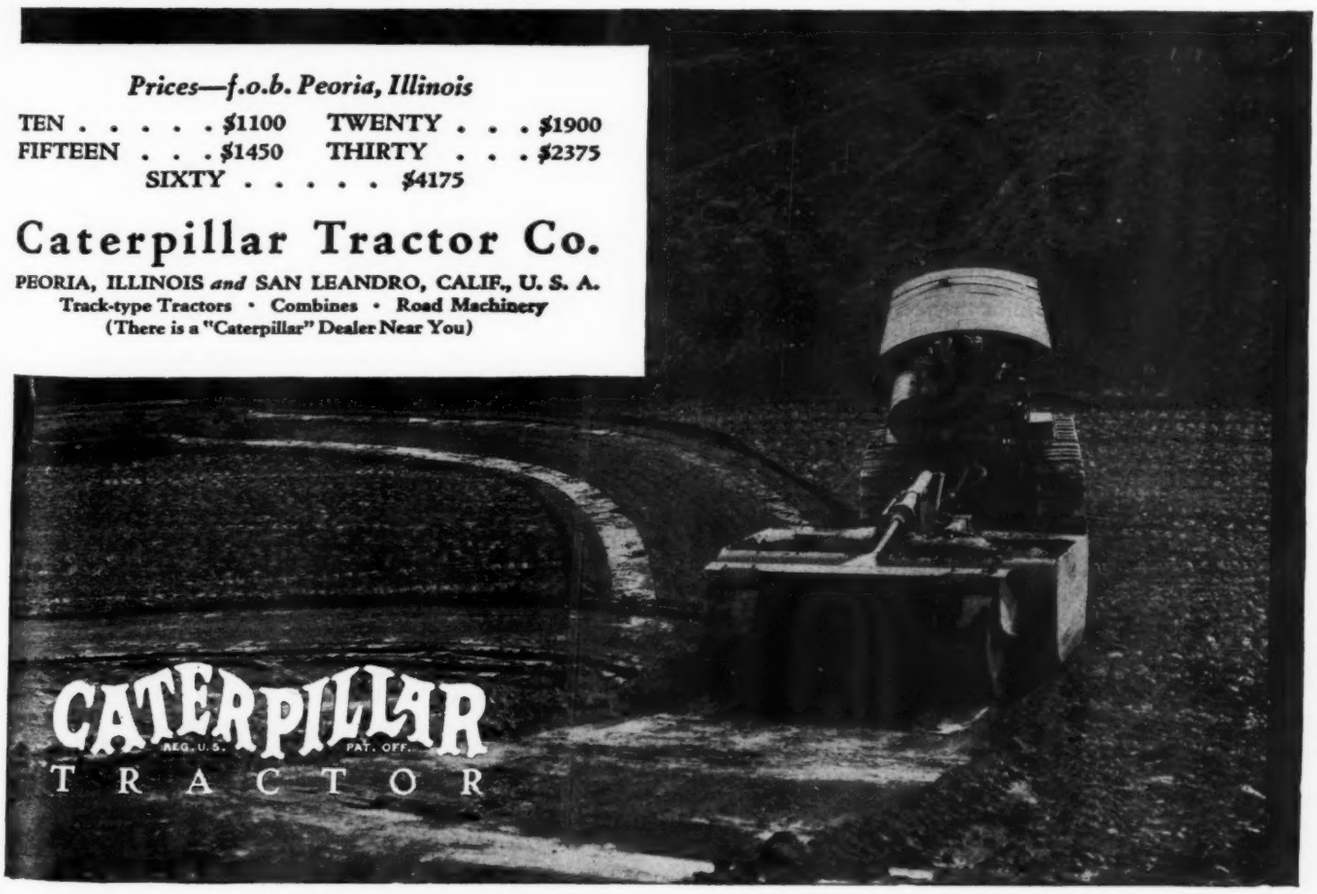

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Acquisition, Maintenance and Operation of Airports by Municipalities*

Decisions by the state courts as to power of municipalities to incur indebtedness for such purposes. Airports included as park, city or other public purpose.

By John Simpson

Airport a Public Purpose

A TAXPAYER of St. Louis, Mo., sought to enjoin the issue of $2,000,000 bonds which had been voted on for the acquisition, improvement and development of land for an airport with the necessary appurtenances.

The first objection was that the issue was not a "public purpose," within the meaning of section 3, art. 10 of the State Constitution. The court said that what constitutes a public use is not easy to define. To the objection that, beyond the right to look on, the ordinary citizen gets no benefit from the tax, the court said: "It is unquestionably true that the airplane is not in general use as a means of travel or transportation, either in the city of St. Louis or elsewhere; and it never will be unless properly equipped landing fields are established." To the objection that an airport could be better provided through private initiative and by private capital, the court said that, on analogy with the grants in aid of the earlier railroads with municipal funds, so with respect to the expenditure of public funds for an airport, "the increased prosperity of a community which might be expected to result from the new means of travel and transportation made the purpose a public one." The subsequent constitutional prohibition of such aid to railroads did not affect the principle that such an expenditure was for a public purpose. And the ordinance authorizing the issue of bonds for an airport did not violate the Constitutional provision as to aid to railroads.

Airport a City Purpose

The second objection was that the acquisition and maintenance of an airport is not a municipal or city purpose, falling within the scope of the powers which may be constitutionally delegated to a city. The court said: "Cities have long exercised the power: To acquire, construct, maintain, control, supervise and regulate docks, wharves, and harbor facilities, including the making of river and harbor improvements in connection therewith; to own and operate ferries; to lay out and improve roads and highways; and to construct and maintain canals, bridges and other works of internal improvement of a public character. . . . An airport with its beacons, landing fields, runways, and hangars is analogous to a harbor, with its lights, wharves and docks; the one is the landing place and haven of ships that navigate the water, the other of those that navigate the air. With respect to the public use which each subserves, they are essentially of the same character. If the ownership and maintenance of one falls within the scope of municipal government, it would seem that the other must necessarily do so. We accordingly hold that the acquisition and control of an airport is a city purpose within the purview of general constitutional law."

While there is no specific reference to an airport in the charter of the city of St. Louis, it was held that the power to establish and maintain an airport is expressly conferred by the broad all-comprehensive language employed in the granting of powers, when construed conformably to the rule of construction which the charter itself provides. Article I, section 1, par. 8 authorizes the city to acquire, maintain, etc., real or personal property within or without the city or State; par. 15 to acquire, maintain, etc., public buildings, works, etc.; par. 35 to exercise all powers not prohibited to it by law. This holding disposed of the third objection that the city is without power to borrow money for the purpose of acquiring and maintaining an airport, even though such purpose were both public and municipal, for by section 8,656, R. S. 1919, any city in the state may contract a debt in excess of annual income *for any purpose authorized in its charter*, upon the assent of two-thirds of the legal voters at an election, and by another section may issue bonds covering the amount of such debt; and power to issue the bonds is also conferred by article 17, § 1 of the Charter. Dysart v. City of St. Louis, (Dec. 6, 1928), Missouri Supreme Court, 11 S. W. (2nd) 1045.

A similar case concerning Kansas City was argued and decided at the same time. The principal difference between the essential provisions of the two charters is that the Kansas City charter gives the city power "to regulate and control the location of aviation fields, hangars and aircraft landing places; to regulate and control the use of all aircraft within or over the city." The court holds, Ennis v. Kansas City (Mo.) 11 S. W. (2d) 1054, that the specification of this power does not under the rule of construction in the charter operate to limit the general grant of power; and that the power to regulate and control the location of aviation fields and the uses of aircraft within and over the city can be most effectively exercised through the ownership and control of an airport.

Chapter 647 of New York Laws of 1928, amending and forming Article 14 of New York General Municipal Law, (entitled "Airports and Landing Fields") authorizes "the local legislative body of a city, or board of supervisors of a county, or the board of trustees of a village of the first or second class, or the town board of a town" to establish, construct, equip, maintain and operate "an airport or landing field for the use of aeroplanes and other aircraft" within the municipality or within ten miles of its boundaries, and to

(*Continued on page 62*)

*Continued from June issue

Just what has Dust Prevention to do with

DUST is a danger sign to everyone concerned with the maintenance of gravel and water-bound macadam roads.

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Finishing Machines on Bituminous Pavements*

General statement concerning advantages of their use and how to use them to the most advantage, on both highways and city streets

By C. L. Donovan
The Lakewood Engineering Company

FINISHING machines, at this writing, have been used successfully on practically all of the so-called "hot mixes" and of late have been used with marked success on such cold mixes as Kyrock. It appears that any mix that is suitable for hand raking can easily and successfully be finished by machine.

Machines are operating where various sizes of plants are in use, some up to a thousand tons per day; but the greater number have been used on plants having a capacity of 250 to 450 tons per day. In a great many cases low production with the average size plant has been due to inability of the road crew to handle the material turned out by the plant. With the application of the finishing machine, the production in several cases has been doubled. In one case where a finisher was installed after a job was in progress, the average production for nineteen days of hand raking was fourteen hundred square yards per day, against an average production to the completion of the job of fourteen days of twenty-three hundred square yards with the use of the finisher, but with four less rakers, the plant having a pug-mill capacity of eight hundred pounds.

Using a finishing machine, it is possible to lay about seven hundred square yards per hour of 18-foot pavement, and more if the pavement is wider, as the machine has a constant forward speed, regardless of width.

Only one back raker is necessary, although where spreader boxes are not used (as in the case of small plants) the usual number of shovelers must be retained. The use of spreader boxes will eliminate all but one shoveler, although two men must be used to operate the boxes.

As an example of the saving due to decrease of labor with the finisher, the following is the crew used on a job before and after a finisher was installed:

Crew used on binder course (re-surfacing old macadam road):

Hand raking	Machine finish
1—Foreman	1—Foreman
10—Shovelers	4—Shovelers*
1—Tamper	1—Tamper
1—Truck dumper	1—Truck dumper
4—Rakers	1—Back raker
2—Roller men	2—Roller men
19—Total	10—Total

Crew used on top course (sheet):

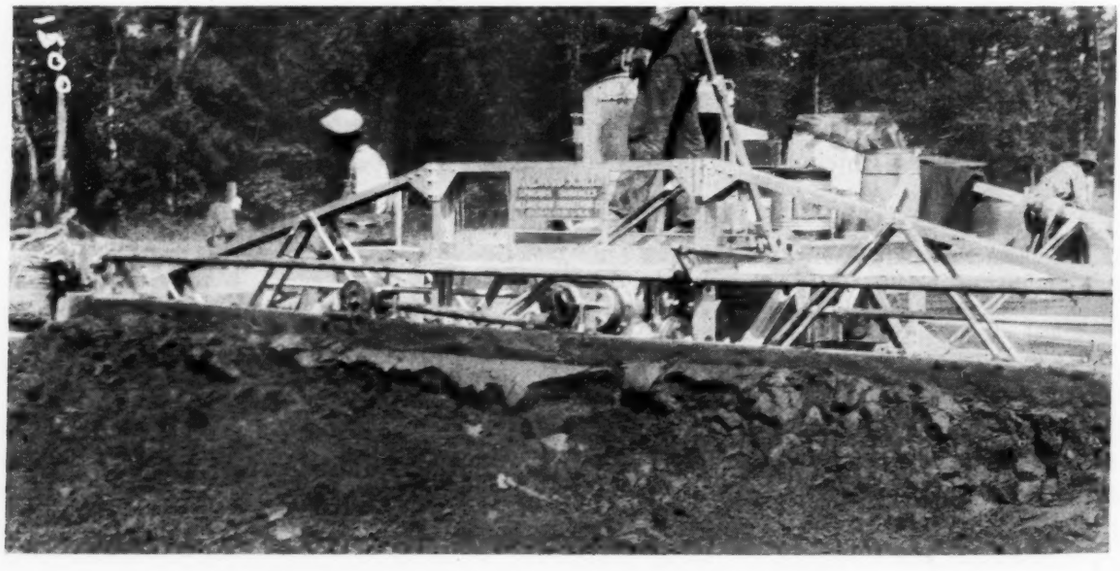
Hand raking	Machine finish
1—Foreman	1—Foreman
10—Shovelers	4—Shovelers*
4—Rakers	1—Back raker
2—Strike-off Templet men	1—Steel strip carrier
2—Tampers	1—Truck dumper
1—Truck dumper	1—Machine operator
2—Roller men	2—Roller men
26—Total	11—Total

One state highway department has observed that there has been a difference of thirty cents per square yard in their contract price on sand-asphalt roads since the use of machine finishing became general in their locality. Another state reports that the price of asphaltic concrete of inch and one-half thickness on new concrete base has been similarly reduced seventeen cents per square yard.

The contractor operating a small plant is at an obvious disadvantage in that he has less chance of

*Paper presented at meeting of The Engineers' Club of Philadelphia.

*In this case the end-gates of the trucks were tied and the material partly spread by the trucks.



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1,084% Increase in 9 years

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realizing the full advantages of machine finish, because of the fact that his crew is practically identical to the crew used by the contractor operating a much larger asphalt plant. Thus, on the larger capacity plant with spreader boxes in use, the contractor not only enjoys a distinct saving in labor, but also achieves a saving in the unit costs of labor due to the greatly increased production of pavement possible to lay.

Where a small plant is in use, it is a distinct advantage to haul the material in small trucks so that the interval between loads will be shorter and the screed member kept at a more uniform warmth. This is especially true on sheet asphalt where the initial compaction under the screed member is about a quarter of an inch, resulting in a surface sealing.

Plants of 350 or more tons capacity daily indicate the use of large trucks, and in this case spreader boxes can be used to decided advantage where machine finish is used. When plants of small capacity are used, the end-gate of the truck can be tied and the material partially spread as the truck dumps. The spreader boxes eliminate the use of a dumping board and shovelers necessary to cut the material ahead of the finisher.

Forms

The machine must, of course, be run upon forms of strength and contour sufficient to support it. Where a concrete base is already in place, the machine is operated on the edge of the concrete header. Many types and sizes of forms have been used. Probably the most popular wood forms have been 2 x 8, 2 x 6, or 3 x 6's stood on edge and fastened to wood stakes. In some cases, where the machine is used to finish both binder and top course, a 4 x 4 is used for the binder course, after which a 2 x 4 is spiked to the 4 x 4 to allow for the top course.

Too much emphasis cannot be placed on the careful setting of the forms, because they are the governing factor of the smoothness of the finished pavement. Where the finisher is operated on concrete headers, the headers should be straight-edged to the required smoothness of the finished pavement.

It is recommended that steel strips be placed on wood forms when a finisher is used, to guard against possible damage to the form from the sliding action of the screed member as well as to bridge any irregularities in the forms themselves. These steel strips can be of suitable thickness to compensate for the roller knockdown, so that the finished material will be left sufficiently high that when rolled it will be of exact thickness. Practically all asphalt finishing machines are provided, however, with adjustable end-shoes which have considerable vertical adjustment to allow for this compression. This feature also permits easy use of the machine on work below the form tops, such as base courses and leveling course work, as through adjustment of these end-shoes the screed member can be operated below the form tops while the end-shoes themselves ride upon the top of the form.

Resurfacing Work

The resurfacing work consists mostly of surfacing old macadam, gravel, and concrete roads. The first course is generally known as the binder or leveling course, which varies in thickness from one to three inches depending upon the condition of the surface being covered.

By lowering the screed member inside of the forms, the leveling course is finished to a true crown and surface. This makes it possible to spread the top course to the same true crown and surface with uniform thickness of material throughout.

City Streets

On city street work, the finisher can be operated on the inside edge of the integral curb and gutter, or on the limestone, granite or concrete curb, depending upon the design in use. In the case of a black base, the finisher can be operated on wood or steel forms if no permanent curb is used.

Where there is not a distinct change in crown at a street intersection, the finisher lays the center strip, and the wings are hand raked. If there is a distinct change in crown, the whole of the intersection is hand raked, either before or after, and the finisher is used only on the straightaway.

Where manholes and monuments are in place, no difficulty is encountered in finishing over them when the top course is laid, if they are properly set when the base is poured. On the binder course, the screed is raised over the objects and the back raker can easily rake the width of the manhole or monument.

On streets wider than thirty feet, the asphalt can be laid in two or more strips. In such a case, it is best to insert small steel dowels, about four inches long, spaced regularly longitudinally down the concrete slab. A wood form is placed over the dowels and the finisher run on this form. As an example, a sixty foot street can be finished in two thirty-foot or three twenty-foot strips. In the case of a street being finished in two thirty-foot strips, one row of steel pins protruding about one inch above base should be placed longitudinally along the street. If three twenty-foot strips are used, two rows will be necessary. These dowels should be placed about every ten feet.

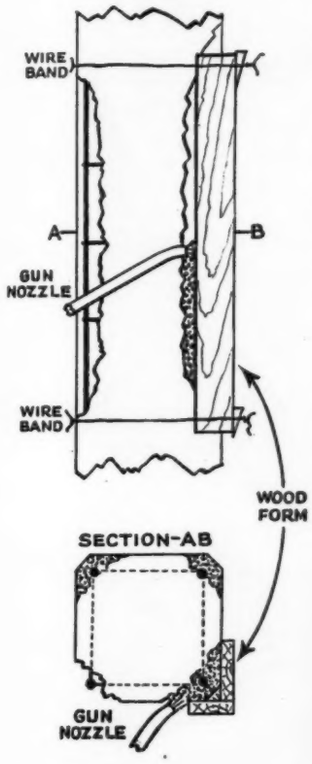
It has been found that sheet tops of less than one inch thickness do not lend themselves to machine finish, because of their tendency to tear caused by the sliding of the material along the base course under the action of the screed member.

Highway Exhibit at Chicago's World's Fair

Chicago is making plans for a World's Fair in 1933, and the Civil Engineering section of the National Research Council Science Advisory Committee is planning an exhibition of highway engineering consisting of 51 items covering a wide range of historical developments pertaining to highway construction, dating back to the early roads located on old hunting and Indian trails. It is expected that models will show early construction equipment, such as pick axes, shovels, wheelbarrows, horse and cart, in contrast to modern machinery and power apparatus. Three of the exhibits will portray typical highway scenes in 1833, the year when Chicago became a city; in 1872, when the first brick pavement was laid in Charleston; and finally in 1933. The typical highway scene of 1833 will present a river, a railroad, a highway, several hills, a plain, a forest, and a sky background. A construction gang will be shown building an old time broken stone road, a side-wheel steamer will be seen in the river, and a toll road with vehicles passing through the gates. The scene of 1933 will show highways being re-located to eliminate grade crossings, to correct alignment and improve gradient.

Repairing Concrete Bath Substructure

MUNICIPAL baths built by the City of New York at Coney Island rest on a reinforced concrete substructure consisting of piles, beams, and concrete floor. Apparently the concrete of the baths was not water-tight, and more or less moisture seeped through the concrete and into the beams and piles as well as the floor itself. All of the concrete had been reinforced, and the moisture finally caused freezing and cracking of the concrete, allowing air and moisture to reach the reinforcement, which then rusted, the expansion of which further broke the bond of the concrete so that in some places considerable sections, even a foot square, could be pulled off with the hand and corners could be knocked off from the piles and beams with very light blows. In a few places the outer surface of the concrete had gone away entirely for lengths of ten or twelve feet. This, of course, was weakening the structure and it became imperative to do something to protect the reinforcement and to build up the concrete before the deterioration went further.



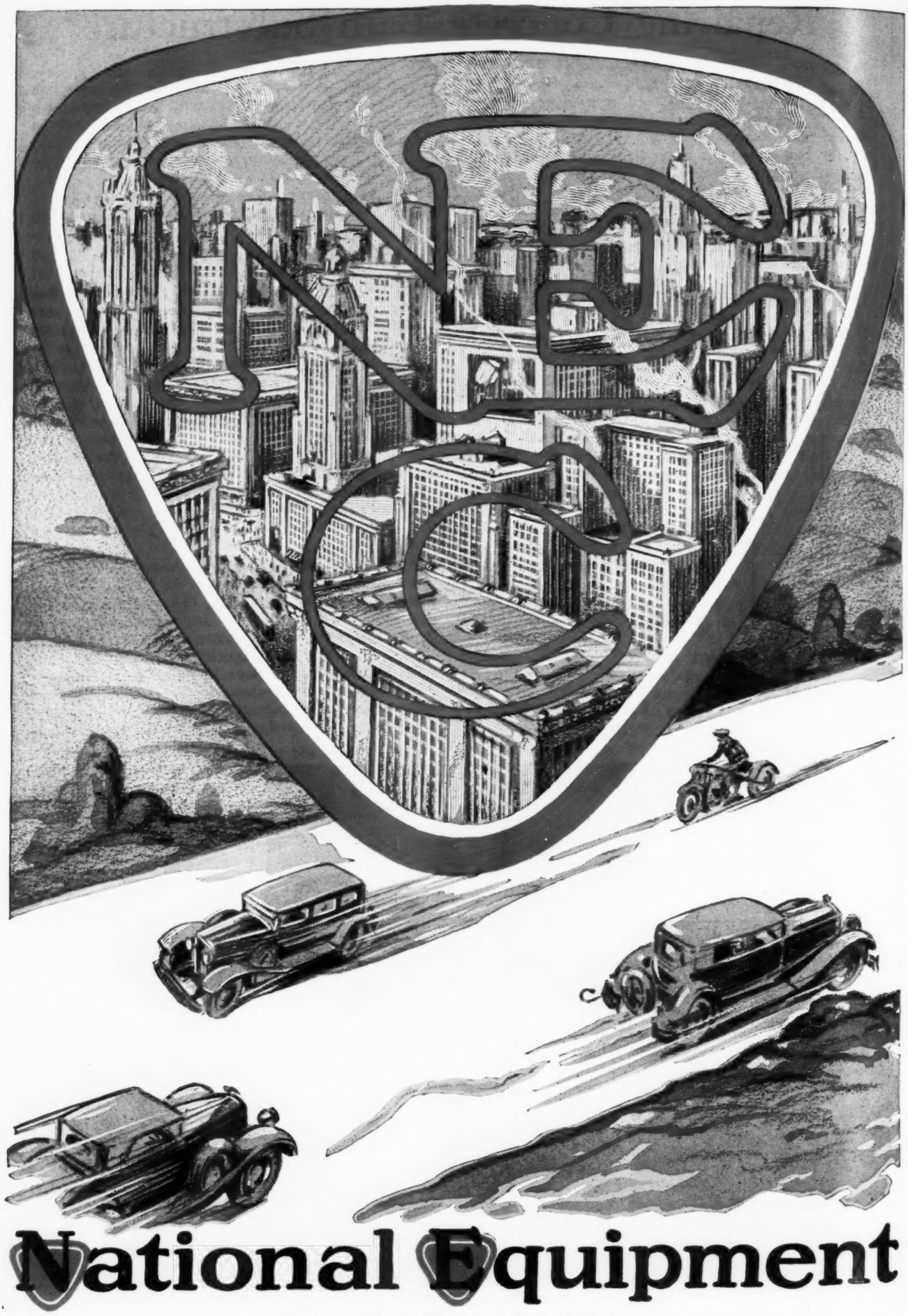
To replace the concrete by means of a troweling method would have required the use of a very plastic mixture, and even then probably would not have made a strong bond with the old concrete. It was decided, therefore, to build up the defective places by means of the cement gun, which would give the new material a firm bond on the old and make a dense concrete under the impact with which it would be gunned into place, excess water working out of the surface as new material was applied.

In making the repairs in this way a mixture of 1-2-2 Portland cement, sharp sand and ¼ inch grit was used and driven into the defective parts under a pressure of 80 to 90 lbs. per square inch. It was applied in successive layers of ¾ in. to 1 in. depth, each of which was allowed to set partially before the next application was made. These successive layers were repeated until each beam and pier had been built out to its original dimension. For repairing many of the piles and beams, a wooden corner form was used, made of 1 in. lumber and securely wired to the pile, or braced against the corner of the beam or girder. The mixture was shot in at an angle from one edge of the form, as shown in the diagram. The new material was stopped slightly below the plane of the finished beam or pile and the surfaces were then gone over with a mixture of 1 cement to 2 sand applied by trowel to restore the uniformity of surface and to give a smoother finish than would be possible with the air gun.

The illustration shows the condition of some of the beams and piles; also the use of the Quigley concrete gun for replacing the concrete. The cement, sand and grit were mixed in a mortar box with sufficient water to make a semi-plastic mixture, which was placed in the gun (which had a capacity of 2 cubic feet) and was discharged into place in four or five minutes, when the gun was reloaded. It shot the concrete through a hose connection, using a ¾-inch pipe nozzle, slightly curved at the tip and having an oblong aperture. Air was supplied by an Ingersoll-Rand portable compressor. The work was done by the Alliance Sand Blasting Company, of New York City.

At Right—Exposure of reinforcement in beams by breaking away of concrete. Below —Making concrete mixture and charging it into gun.

Below, Center — "Gunning" concrete onto beam. Air under 80 pounds pressure supplied through hose from compressor 100 feet away. Below, Right—Reconstructed parts of girder and beams indicated by light - colored areas.



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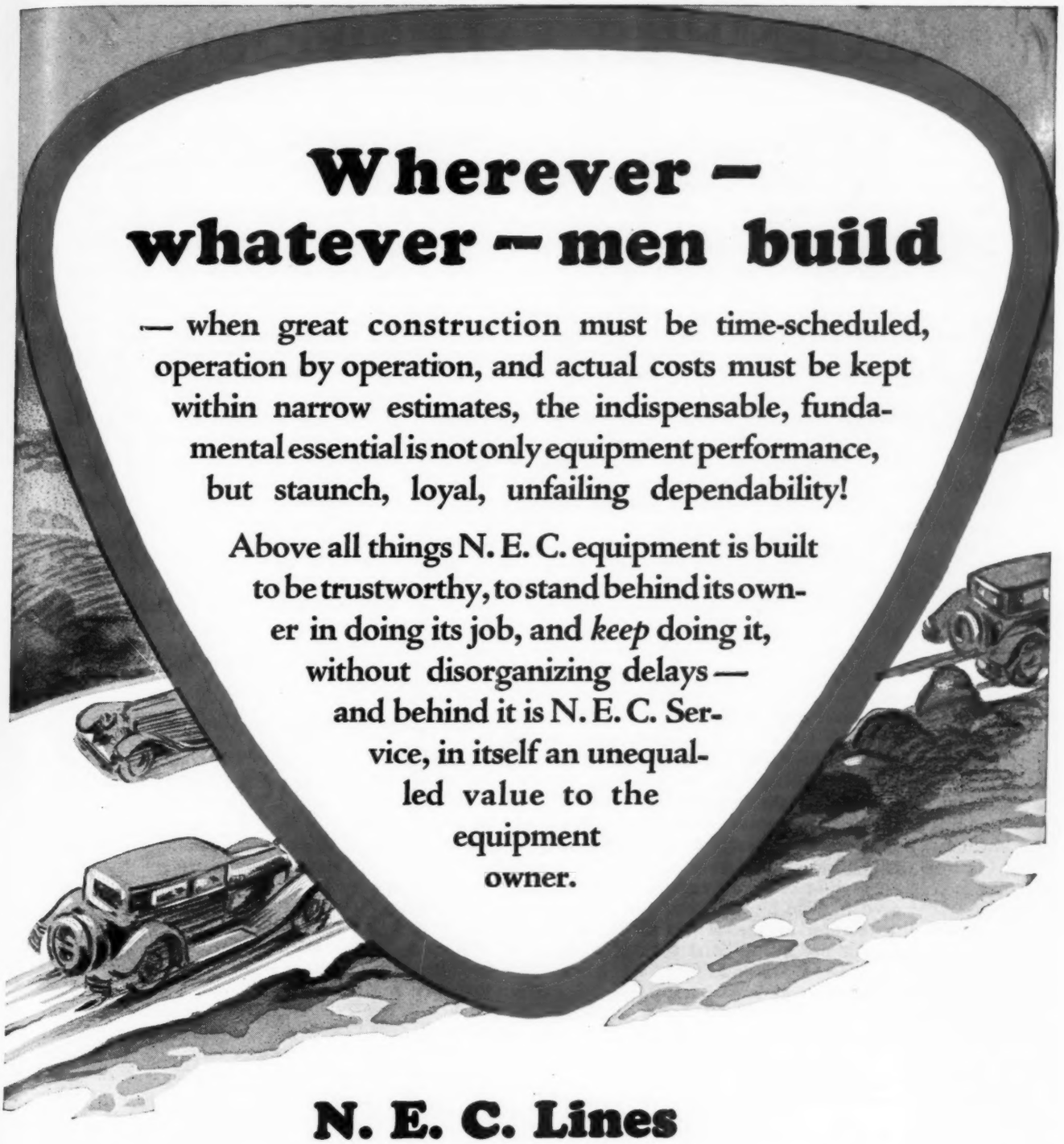

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RECENT LEGAL DECISIONS

By John Simpson

DISPOSAL OF RETAINAGE WHEN DEBTS REMAIN DUE TO MATERIALMEN

A contract between a building contractor and a board of education for the construction of a school building provided that the contractor should be paid as the work progressed 85 per cent of the value of the work then done and of material therefor on the ground, proportionate to the contract price for the building, the remaining 15 per cent to be paid to him on the completion of the building. After completion of the work a balance remained due to the contractor. He had failed to pay certain materialmen, and the city and board of education brought suit against the contractor, his surety and the materialmen and deposited the fund in court for disposal. The Mississippi Supreme Court held, Mississippi Fire Ins. Co. v. Evans, 120 So. 738, that the 15 per cent retainage provision in contracts of this description is one of the owner's securities for the performance of the contract by the contractor, and also constitutes a fund to which the contractor's surety has the right to resort in the event it is compelled to pay debts due by the contractor to laborers and materialmen. This right of the surety does not arise until the contractor has completed the work he agreed to do, or has defaulted thereon, and the surety has been compelled to perform it. While the contractor is proceeding with the work the surety has no right to the money which, under the contract, the contractor receives as the work progresses.

The contractor's failure to pay laborers and materialmen was a breach of his contract, and his surety was liable to the laborers and materialmen for the amounts due them by the contractor; but no liability to them was thereby imposed on the city or board of education, neither the contract nor any statute so providing. The Mississippi statute gives laborers and materialmen a right of action against the surety for debts incurred to them by the contractor, but imposes no liability therefor on the owners of the building. The retainage is not a trust fund for the payment of such debts. The Mississippi court has frequently held that laborers and materialmen have no claim against the state or other public body, in the absence of a valid contract or statute so providing, for labor or material furnished for any public work. For these reasons the plaintiff's claim for an attorney's fee in the suit for distribution of the fund was disallowed.

CONTRACTS FOR PART OF PUBLIC BUILDING EXHAUSTING ANNUAL LEVY

The West Virginia Supreme Court of Appeals, Swiger v. Board of Education of Sardis Dist., 147 S. E. 708, holds that contracts made by a board of education for the erection of the foundation, walls, and roofs of school buildings, by which all its funds available for the fiscal year are exhausted, necessarily involve the levies of the succeeding year or years for their completion and use, and violate the spirit and intention of W. Va. Code, c. 28a, § 12, which makes illegal and void any contract of such board, express or implied, the performance of which in whole or in part would involve the expenditure of money in excess of funds legally at its disposal for the current fiscal year.

TRUCK OWNER WORKING FOR PAVING CONTRACTOR HELD AN INDEPENDENT CONTRACTOR.

A paving company in resurfacing streets, employed truck owners to haul its heated asphalt from the plant to the points where repair work might be under way. When this was necessary a truck owner would be called by telephone and offered employment. An owner, so employed, who kept his truck under his own control, paying operating expenses, including cost of oil and gasoline, and who drove in person, was paid by the paving company by the hour. A foreman of the company directed him as to the asphalt to be loaded and as to the place of unloading. He selected his own course between the points. While hauling asphalt he injured a pedestrian, who sued the paving company. The Pennsylvania Supreme Court held, Long v. Eastern Paving Co., 295 Pa. 163, that the truck owner was not an employee of the paving company, but an independent contractor, for whose negligence the paving company was not liable. The rule applied by the Pennsylvania court is thus stated: "Where a contract is let for work to be done by another in which the contractor reserves no control over the means of its accomplishment, but merely as to the result, the employment is an independent one establishing the relation of contractee and contractor and not that of master and servant."

RECOVERY BY MUNICIPALITY ON BOND SECURING CONTRACT IN WHICH OFFICIAL IS ILLEGALLY INTERESTED.

Wisconsin St. 1927, § 348.28, provides that a public official who, in his official capacity, makes a contract in which he has a pecuniary interest, is subject to heavy penalties. The Wisconsin Supreme Court holds, Washington County v. Froehlich Mercantile Co., 223 N. W. 575, that the fact that a county supervisor was a stockholder in a mercantile company at the time of making a contract with the company for its furnishing supplies for the construction of a highway was no defense to the county's action on the bond securing the performance of the contract. The purpose of the statute is to prevent the public from being the victim of loss through the willful misconduct of its officers. Generally, it is held that a contract entered into in violation of a penal statute is void; but, the Wisconsin court says, there are many exceptions to the general rule, and a distinction must be made between the corporate municipality and its agents who perform the illegal act and violate the statute.

EFFECT OF DECREASE IN POPULATION ON MUNICIPALITY'S CLASSIFICATION

A municipal township grows out of a law by reason of decrease in population as well as growing into a law by reason of increase in population. State v. Summers, (Mo. App.) 9 S. W. (2d) 867.

MATURITY OF MUNICIPAL BONDS MAY BE FIXED BY STATE CONSTITUTION.

Where a power is given to a municipality to issue bonds under certain conditions and the date of the maturity of the bonds is fixed in the same provision of the state Constitution, this would be a restriction upon the power of the municipality to fix another, or different date for their maturity. Hargraves v. Solomon, Arkansas Supreme Court, 9 S. W. (2d) 797.

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MAXIMUM closing speed is obtained in Owen Buckets by reducing cable overhaul from 5 or 6 parts of line to 5, 4, 3 or even 2 parts, whichever is required for full loads. Adjustable undiminished closing power for all kinds of digging is assured by the Owen designed block and tackle. All leads are straight from groove to groove in each sheave regardless of the number of parts of line used.

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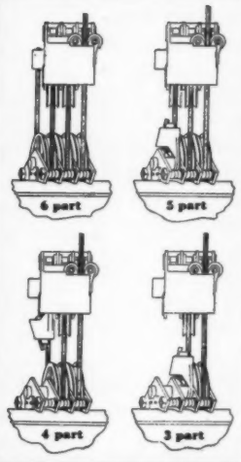
6012 Breakwater Ave., Cleveland, Ohio



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16. Heavy duty high carbon drop-forged steel teeth.
17. Lips or teeth points hit first.

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CLAMSHELL BUCKETS
MAKING A BIGGER DAY'S WORK

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HIGHWAY CONTRACTOR'S CLAIM FOR STATE'S FAILURE TO FURNISH A RIGHT OF WAY.

The Indiana Appellate Court, State v. Feigle, 162 N. E. 55, holds that the claim of a highway contractor against the State for breach of contract in failing, neglecting and refusing to furnish a right of way was one for breach of contract and not for tort. The mere fact that the breach of contract involved was the result of the failure of some of the officers of the state to perform their official duties did not make the action one of tort instead of contract. So that although the state was not liable in damages for the neglect of its officers and agents, it was liable for the breach of the contract.

Although the state is one of the parties to such a contract, it must be construed as if it were between two individuals, since the state in entering into the contract laid aside its sovereignty, and bound itself substantially as one of its citizens does when he enters into a contract. It is the duty of the state, under such a contract, to furnish to the contractor, in time not to hinder him in the progress of his work, a place to construct the highway, and it is liable in damages to the contractor for its delay in doing so.

Where the contractor was bound by the specifications to follow the engineer's direction as to lines, grades, and measurements, he should be reimbursed for damages sustained because of the engineer's mistakes, in the absence of any provision in the contract that there should be no recovery because of such mistakes.

The contractor is not given the relief to which he is entitled by the clause in the specifications providing that "Whenever the work is delayed or suspended through no fault of the contractor or whenever extra or additional work is required, the director shall allow a reasonable extension of time for the final completion of the contract." This clause was intended to cover such hindrances as inclement weather, fire, breakage of machinery—such happenings as were not the fault of the contractor, nor of the state.

The contractor, it was held, was not obliged to abandon the work and sue for damages, but could complete the work and then claim damages.

UNCOMPLETED PAVING CONTRACT—OWNER'S DEFENSE TO ACTION FOR SPECIAL ASSESSMENT.

Where a city council entered into a contract for paving nine blocks, but the work was stopped when six blocks were completed, when the lot owner at the terminus of the pavement was sued by the paving company for a special assessment, the Texas Court of Civil Appeals held, Harwell v. Jordan Const. Co., 4 S. W. (2d) 980, that the lot owner was not estopped from defending, because of his failure to object to the contract at the hearing before the city council, on the ground that the pavement as laid left him on the terminus instead of furnishing him a south outlet and proper drainage. The fact that the city was without authority to contract for and accept the work as done without giving abutting owners an opportunity to show lack of benefit was held to preclude the contractor from recovering on the paving certificate.

ESTOPPEL BY DELAY TO ENJOIN PAVING ASSESSMENT FOR IRREGULARITY OF PROCEEDINGS.

The Nebraska Supreme Court holds, Wookey v. City of Alma, 223 N. W. 953, that the special provision embodied in the charter of Nebraska cities of the second class having a population of less than 5,000, authorizing the city council to pave a street by assent and vote of three-fourths of its members, is not amended or repealed by the provisions of section 8336, Neb. Comp. St. 1922, as amended by Laws 1925, c. 158, § 1; and, further, such paving is not a work of internal improvement within the meaning of the State Constitution, art. 13, section 2, requiring a proposition therefor to be submitted to the qualified electors.

It is also held that where taxpayers of an improvement district stand by while work on a paving project is being prosecuted in good faith and see acts done involving risk and expense to others, with knowledge that some of the proceedings preliminary to letting the contract have not been in strict conformity with statutory provisions, without effort to prevent the prosecution of the work, they are estopped to enjoin the collection of special assessments to pay the cost.

SUFFICIENCY OF DESCRIPTION OF IMPROVEMENT—PAVING ORDINANCE TO EXCLUDE PORTION REQUIRED TO BE PAVED BY RAILWAY COMPANY

Where the plan of a proposed improvement is attached to, and made a part of, an ordinance, the Illinois Supreme Court holds, City of Springfield v. Gillespie, 335 Ill. 388, 167 N. E. 61, that it should be considered as if incorporated in full in the ordinance. Uncertainty in the description of an improvement may be removed by reading together the estimate of its cost and the ordinance with the plat attached thereto. So a street paving ordinance providing for storm-water inlets to be connected with the sewer as indicated on the plat and profile thereto attached was held not void for uncertainty, where the location of the inlets and the course of pipe connections with sewers were shown on the plat and profile.

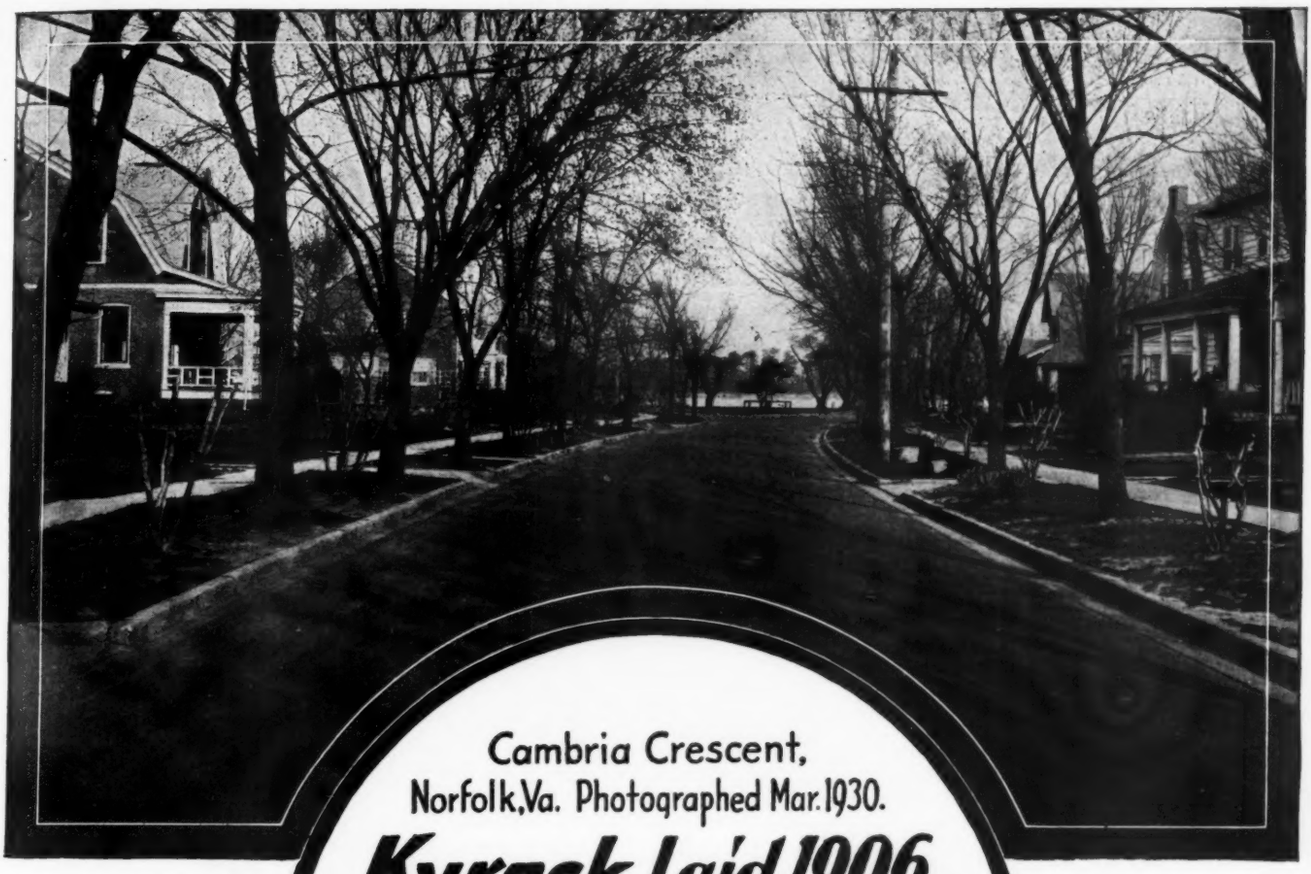
Where a franchise ordinance requires the street railway obtaining it to pave its right of way at the time and in the manner in which the remaining portion of the street is to be paved by the city, the requirement will be regarded as the equivalent of a special assessment on the company's right of way for paving the street and to preclude a further assessment for that purpose. Under such circumstances it is proper to exclude the portion of the street occupied by the street railway company from the provisions of the paving ordinance.

EXTENSION OF TIME ALLOWED PAVING CONTRACTOR

The Missouri (Springfield) Court of Appeals holds, City Trust Co. v. Cunningham, 20 S. W. (2d) 930, that contracts for street improvements should be subjected to a reasonable analysis and construction, in a spirit of justice, for the welfare of the contracting parties and the community, and the court may reach the conclusion that there has been a substantial compliance with the contract even though there might have been some deviation from a strict and literal performance of some of the details. An extension of time given a paving contractor beyond that stated in the advertisement for bids and in the contract was held reasonable, in view of war conditions then prevailing, where there was no evidence of any secret understanding between city officials and the contractor, or of loss suffered thereby by any interested person; and the tax bills for the improvement were not thereby invalidated.

BURDEN OF SHOWING INVALIDITY OF COUNTY WARRANT.

Whoever attacks the validity of a county warrant must sustain the burden, and must establish that the warrant is invalid. Pulaski County v. Richardson, Kentucky Court of Appeals, 9 S. W. (2d) 523.



Cambria Crescent,
Norfolk, Va. Photographed Mar. 1930.

Kyrock Laid 1906

24 Years under Traffic
Maintenance-Negligible

A Good Street To-Day

Cambria Crescent, Norfolk, Va.
A Kyrock surface, now in its 24th year of continuous service. It is without ruts, cracks or waves. Its resiliency is unimpaired. Test measurements do not disclose any abrasive wear and its surface retains its initial coefficient of friction. Laboratory tests of samples cut from this surface in February, 1930, show no chemical change in the bitumen and no loss in bitumen content. Kyrock does not lose its *life*.

Many miles of streets and highways of various types laid 10, 15 years ago have taken a toll for maintenance equal to their original construction cost—many have disintegrated and been replaced. This Kyrock street has given uninterrupted service for 24 years at but little more than its original construction cost. It is good for many years to come. On the basis of cost per mile per year, Kyrock is the cheapest material available.

Investigate Kyrock. KENTUCKY ROCK ASPHALT CO., *Incorporated*, Marion E. Taylor Bldg., Louisville, Ky.

Kyrock
The Uniform Pavement

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Efficiency of Great Lakes Water Purification Plants

Some results of study of fourteen such plants by U. S. Public Health Service

AT the joint request of interested local and state authorities, the United States Public Health Service has made a survey of fourteen representative municipal water filtration plants situated on the Great Lakes and connecting waterways, including those of Detroit and Cleveland, to study the efficiency of such plants; and incidentally compare it with that of plants on the Ohio and other rivers of the Middle Western and Eastern states, of which a similar survey had previously been made. A report on this study, written by H. W. Streeter, sanitary engineer of the Service, has been published by the P. H. S.; which has also prepared the following synopsis of the report:

Approximately ten million people derive their water supply from the Great Lakes, and the sewage and industrial wastes of five and one-half million are discharged into them. . . .

Owing to the great importance of the Great Lakes region from standpoints of population, commerce, and industry, the maintenance of safe water supplies along these lakes constitutes one of the major water-purification problems of the country. With the increasing pollution of sources of water supply located in various marginal zones of the lakes, this problem is becoming a more difficult one each year, taxing at present, in some instances, the resources of modern water purification.

The difficulties of obtaining safe purified water supplies from the Great Lakes are magnified considerably by the extreme variability existing in conditions of pollution of the lake waters at the several water intakes, which are located in or close to marginal zones of shore pollution, where water movements are subject to the vagaries of winds and countercurrents. In some instances the pollution of these zones probably is subject to seasonal variation, due to large increases in the sewered population residing along the lakes during the summer vacation season.

A study of the performance of the 14 Great Lakes plants included in the survey revealed some interesting similarities and contrasts in the behavior of these plants, both among themselves and in comparison with purification systems of the Ohio type. Perhaps the most striking similarity observed was the existence, at practically every plant, of a well-defined relationship between the bacterial quality of the raw water, as delivered for treatment, and the corresponding quality of the effluent produced at each successive stage of purification. This same relationship, which is one of fundamental importance, had been noted previously in studies of water purification on the Ohio river and on other rivers.

The most important dissimilarity observed was the marked variability in average bacterial efficiency shown by the several Great Lakes plants among themselves and their disparity in this respect from Ohio river plants of the same general type. Among the Great Lakes plants, divergences in efficiency were indicated as being due in some cases to differences in the average density of raw water pollution and in certain features of plant design and operation. In other instances no reason could be assigned for the inequalities noted.

As regards the comparative bacterial efficiency of the Great Lakes and the Ohio river plants, the former were shown consistently to be slightly less efficient with chlorination included, and decidedly less efficient with chlorination excluded, than the latter group. Detailed analyses of the data failed to disclose the reason for these divergences, which do not appear to be explained, as currently assumed, by the relatively lower turbidity of Great Lakes water. It is suggested that they possibly may be due to differences in the chemical composition of the two waters, notably in the hydrogen-ion concentration.

From a study of the relationships observed between the bacterial qualities of the raw waters and effluents of the Great Lakes plants, and from an analysis of their variations, it was concluded, in so far as the production of final effluents conforming to the revised Treasury Department *B. coli* standard is concerned, that an average density of *B. coli* in Great Lakes raw waters, as delivered for purification, approximating an index of 4,500 per 100 cubic centimeters appears to represent an upper limit of permissible pollution, beyond which a majority of the Great Lakes filtration plants, as at present designed and operated, would be clearly overburdened. Mean densities ranging from 1,000 to 4,500 per 100 cubic centimeters represents a doubtful zone, within which some plants might be and others might not be overburdened for a significantly large proportion of the time. With average densities ranging below 1,000 per 100 cubic centimeters, the majority of such plants would not be expected to be overburdened except for a comparatively small proportion of the time.

Among the areas studied, the most highly polluted zone of the Great Lakes from which water is taken for purification was located at the extreme southern end of Lake Michigan, where existing purification systems are clearly overburdened. Other zones of relatively high, though not in all cases excessive, pollution were found to be at the extreme western end of Lake Erie, at the outlet of the Detroit river, and along the southern shore of Lake Erie between Cleveland and Sandusky.

As long as the supply for free distribution lasts, persons especially interested in the subject may obtain without charge a copy of the bulletin containing this report by addressing the Surgeon General, United States Public Health Service, Washington, D. C.

Paving Asphalt Sales in 1929

According to a report made in June by the Department of Commerce, solid and semi-solid petroleum asphalt (less than 200 penetration) sold at refineries in the United States for paving purposes increased from 1,549,354 short tons in 1928 to 1,569,858 in 1929; while flux for paving (more than 200 penetration) increased from 127,177 short tons to 185,256.

Paving asphalt constituted 43.4 per cent of the total tonnage in 1928 and 38.8 per cent in 1929, roofing asphalt constituting about two-thirds of the balance.

The amount received at the plant for solid asphalt, however, decreased from $21,271,309 to $19,462,460; but that for flux for paving increased from $2,144,663 to $2,750,692.

Imports of asphalt increased 1.2 per cent, from 119,588 tons in 1928 to 121,019 in 1929; most of it coming from Trinidad, Venezuela and Cuba. In 1929.

Sewage Treatment Plant at Colorado, Texas. Three Simplex Units.

One of the first

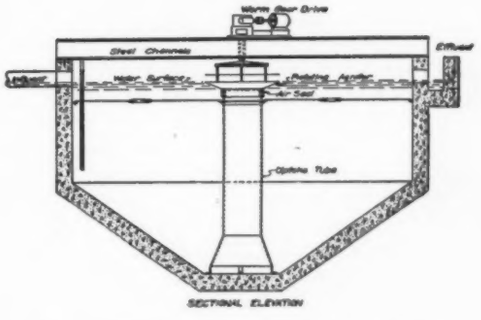
THE Simplex mechanical surface aerators pictured above have been in continuous service since September, 1925.

There are now many sewage treatment plants equipped with Simplex aerators in service in the United States. In addition to the plants listed below there are many in process of design or construction at this time.

Simplex Plants in United States

City of Colorado, Texas
City of Garden Villas, Texas
City of Dunsmuir, Cal.
Glen Lake Sanitarium, Minn.
City of Rochester, Minn.
City of West Concord, Minn.
City of Norwood, Minn.
City of Buhl, Minn.
City of White Bear, Minn.
City of North St. Paul, Minn.
City of Princeton, Ill.
City of Christopher, Ill.
Woman's Reformatory, Dwight, Ill.
City of Lawton, Okla.
City of Frederick, Okla.
City of Lemoore, Cal.
City of Madison, Ohio
City of Liberal, Kan.
City of Vandalia, Mo.
Rock County Asylum, Wis.
State Hospital, Farmington, Mo.
Jackson County, Asylum, Mo.
Haskill Institute, Lawrence, Kan.
Caterpillar Tractor Co., Peoria, Ill.
State Insane Hospital, Manteno, Ill.

Single Simplex AERATOR unit in tank



The revolving aerator receives its sewage through the uptake tube from bottom of tank and is equipped with vanes that throw an upper and lower film of sewage over the surface of the tank. Oxygen absorbed by the films, the surface agitation and complete circulation of sewage will give any degree of nitrification desired, determined by the detention period in the tank.

Sole Manufacturers in the United States and Canada

SIMPLEX *SURFACE* AERATOR

SIMPLEX EJECTOR AND AERATOR CORPORATION

2528 W. Madison Street, Chicago

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69,908 tons came from Trinidad, 36,605 tons from Venezuela, and 12,854 tons was grahamite from Cuba.

Exports of petroleum asphalt decreased 2.6 per cent, from 492,362 tons in 1928 to 479,404 in 1929; a decrease of about one-third in exports to western Europe being almost offset by increases to the Far East, Italy and Cuba, the last named jumping from 105 tons in 1928 to 19,609 in 1929.

Sales of native rock asphalt decreased from 760,497 tons in 1928 to 748,550 in 1929. But sales of that mined in Kentucky increased from 318,548 tons to 340,346 in 1929; and that mixed in Uvalde and Kinney counties, Texas, decreased only slightly—from 321,505 tons to 320,931. Exports of natural rock asphalt increased from 26,263 tons in 1928 to 46,962 in 1929.

Cement and Asphaltic Concrete Paving on California Roads

Smoothness increased considerably by machine finishing. Contractors making speed records also laid smoothest pavements. Stability tests

PAVEMENT construction on California's state highways in 1929 showed considerable progress in a number of directions, according to a report by Earl Withycombe, assistant construction engineer.

Machine finishing of asphaltic concrete pavement was the general practice last year, being used for 63.6 miles of pavement, while hand finishing was used for only 4.0 miles. Machine finishing began in 1927 with 12.2 miles out of 38; in 1928 it increased to 37.2 miles out of 44.8; and, as stated, was used for 94 per cent of the total in 1929.

The roughness of the machine-finished pavement has each year been considerably less than that of hand-finished. The average roughness, in inches per mile, was 14.6 for machine-finished and 25.2 for hand in 1927; in 1928 the records were 14.7 and 30.9 respectively; and in 1929, 13.6 and 20.9. However, the smoothness of machine-finished varied considerably in the five different districts in which it was used, being 8.3, 8.6, 13.0, 13.8 and 20.0 inches respectively, averaged by districts; and ranging between 7.9 and 20.2 by contracts.

Portland cement concrete pavement is still smoother, however, averaging 8.2 inches for last year, with a range by districts between 7.0 and 11.3; and a range by contracts between 4.4 and 17.4.

The finishers used on both cement and asphaltic concrete were Ord and Lakewood make; and Koehring, Rex, Foote and Ransome mixers were used for concrete; and Madsen, Geiger, Totman, and Union Tank & Pipe Co. for asphalt. The roughness appeared to have no relation to the make of either mixer or finisher used.

The cubic yardage laid per day, averaging for each contract, ranged from 90.7 to 361.6. The roughness of the latter was less than half that of the former; while the pavement with the second highest record, 308 cubic yards, had the lowest roughometer index. Apparently it is not necessary to sacrifice smoothness for speed.

The same is true of asphaltic concrete, also; for the pavement on which the record for speed was made—790.7 tons per day—also had the record for smoothness—7.9 inches; while that with the minimum tonnage was the roughest.

It was definitely proven in last season's construction that delayed finish of cement concrete pavements resulted in smoother riding surfaces, and this is being practiced on all subsequent work. Nearly all jobs have increased production to the point where two finishing machines or two heavy longitudinal floats are necessary in order to secure compaction, and delayed finish is secured by maintaining the maximum interval between the two machines or the floats, as the case may be.

Pavements are opened to traffic, following an 8-day watering period, on the basis of strengths developed by beams cast and broken in the field.

The strength of the concrete after 28 days, averaging by contracts, ranged from 3,183 to 5,238 pounds per square inch.

Of the jobs selected for casting by headquarters, seven were selected by the laboratory for coring. The laboratory cores, after being corrected for height and age, show an average compressive strength of 4894 pounds per square inch, the corresponding headquarters casts show 4401 pounds, and the field casts show 3848 pounds per square inch. Assuming that the cores represent the true strength of the concrete in the pavement it would appear from this analysis that the headquarters casts represent but 90 per cent of the actual strength of the concrete and the field casts, but 79 per cent.

In the past it has been the practice to include in the 6-inch by 12-inch cylindrical cast a true representation of all the aggregate contained in the pavement mixture. It was questionable whether the maximum size aggregate, two and one-half-inch material, did not unduly influence the resulting strength in a cylinder of such dimensions, and it was later proven by our own investigations that such was the case. It then became a question as to the advisability of increasing the dimensions of the specimen to take care of the maximum size of rock or uniformly eliminating from the material selected for casting, all of the aggregate above a certain screen size. To increase the size of cylinders would have resulted in discarding a considerable portion of our field and laboratory equipment. It has been decided to screen the mixture on a one and one-half-inch square mesh prior to casting in order to secure uniformity. The early results from this method are exceptionally encouraging.

Since the latter part of the 1929 construction season, mixtures of asphaltic concrete are being designed and controlled by means of the stability test of the mortar content. The fine aggregate for a project is selected prior to the letting of the contract by means of relative stability values and often a convenient source of sand that would otherwise be rejected on the basis of specification requirements for sieve analysis is accepted if these stability values are satisfactory. This method has resulted in a wider use of local materials with a consequent saving in cost.

Samples are taken at two-hour intervals during the operation of the plant, screened through the 10-mesh sieve while yet warm and submitted daily to the laboratory for a stability test. A rational use of this stability value is attempted at all times. Realizing the danger of sacrificing the qualities in the resulting pavement that prolong its useful life, no attempt is made to secure unreasonably high stability values.

Socony Cold Patch constructed by State Forces at Glenmont Bridge, Albany County, N. Y.

STANDARD ASPHALT PRODUCTS

(Socony Brand)

Standard Asphalt Binder A
for surface treatment

Standard Asphalt Binder B
for penetration work

Standard Asphalt Binder C
for the mixing method

Standard Asphalt Joint Fillers
for brick or block pavements

Standard Cold Patch Asphalt
for repairing all types of bituminous road surfaces

Standard Refined Asphalt
for sheet asphalt paving

Standard Paving Flux
Bridge Asphalt and Preserving Oils

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Sewage Disposal at Salinas, California

Improvements under construction provide for treating trade wastes separate from domestic sewage

SALINAS, CALIF., with a population of 8,000, is the commercial center of an agricultural area. Its sewage contains not only the domestic waste of this population but also industrial wastes from a gas plant, milk condensary and a fruit and vegetable cannery. The city first began building sanitary sewers more than thirty years ago, with an outfall sewer three miles long discharging into the Salinas river. As the city grew the sewers were extended but as the land is exceedingly flat the grade of the sewers brought them up close to the surface of the ground at their upper ends.

To avoid creating a nuisance by discharge of sewage directly into the river, the city purchased a tract of sandy land in the river bottom at the end of the outfall sewer and discharged the sewage onto this, where it was allowed to seep through sand dikes. Pools of sewage formed, but as this point was isolated there was practically no complaint about it. But as the sand clogged more and more and the sewage increased in amount, the dikes would occasionally break and the sewage flow directly into the river. No water supply was taken from the river between the sewer outlet and the ocean, but a few miles below the outlet the river is used for bathing, boating and fishing, and the city officials realized the possibility of injury to fish-life and objectionable features to the bathing and boating. There were also complaints of odors and objectionable floating matter along the river below.

In 1917 the city installed storm sewers discharging into a drainage canal, which served the greater part of the city as then developed. But no new sewers have been built in recent years and in several sections the immediate construction of storm sewers is pressing.

Industrial wastes are not supposed to be discharged into the sanitary sewer, but those from the gas plant, milk condensary and a fruit and vegetable cannery are discharged into the drainage canal which passes through the city and cause odor and fly nuisance.

By the end of 1927 the need for extending the domestic and storm sewerage systems and for adequate disposal of the domestic sewage and industrial wastes became very pronounced. The problem was studied by the city engineer, Howard Cozzens, who requested the counsel to employ the Burns & McDonnell Engineering Co. to report upon the problem. This firm was engaged in March 1928, and submitted its report several months later; and in February 1929, the people voted by a large majority for a $350,000 bond issue for carrying out the construction according to these plans. Detailed plans and specifications were then prepared and bids received in July and contracts awarded shortly thereafter.

The improvement as now under construction involves a complete separation of the trade waste and domestic sewage. The sewage is to be treated in a plant which will provide preliminary and final sedimentation, activated sludge treatment with spiral flow aeration, and separate sludge digestion. The gas from the digestor will be collected and burned. At present the burning will be used merely to prevent odors, but the gas can be used for heating the digesting sludge if it is found desirable. It is said that this is the first plant in California which combines all of these advanced ideas in sewage treatment.

As the old outfall sewer had gotten into bad shape, a new vitrified clay pipe outfall is to be constructed and a pressure effluent line of centrifugal spun reinforced concrete pipe has been constructed from the plant to the river. Low-lying districts situated beyond the reach of the existing sewers are to be served by collecting systems, the sewage from which will be pumped into the existing mains by several small pumping plants.

To provide for removal of storm water, a storm sewer is being built from the southeast portion of the city to the river. This will carry not only surface water but also the effluent from industrial wastes after they have received preliminary treatment. The studies made by the engineers brought out very clearly the fact that all industrial wastes should be kept separate from the domestic sewage and, so far as practicable, each industry should clarify its own waste at its own plant to a greater or less extent. As the city is zoned, and all industry will be concentrated within the industrial district, it was found entirely practicable to serve this district by a combination storm water and industrial waste sewer system. By careful regulation of the waste at the milk condensary and by continuing the filtration of gas plant wastes through coarse sand at the gas plant, it is believed that these wastes may continue to be discharged into the drainage canal. Waste from the fruit and vegetable cannery cannot be discharged into the canal, even with pre-treatment, without causing a nuisance, and the city is constructing a plant for treating these wastes by fine screening through a revolving drum screen, followed by sedimentation with a mechanical type clarifier. The clarified effluent will discharge into the storm sewer, which will carry it to the river, where it will be spread over natural sand beds. The screenings from the cannery will be deposited in cans, and the sludge deposited in the clarifier will be pumped to a storage tank. Both screenings and sludge will be trucked daily to a place of disposal outside the city limits. This plant will be operated entirely at the expense of the cannery.

It is probable that, as these industrial wastes increase in amount, treatment upon the natural sand beds may become impracticable, and it is planned at that time to provide further treatment at the site of the sanitary sewage treatment plant, near which the storm sewer passes. Meantime, it is proposed to conduct experiments on treating these waste effluents to determine what method will be best.

Airport Drainage and Surfacing

The Aeronautics Branch of the Department of Commerce has announced that "the technical resources of the American Engineering Council, the American Road Builders Association and the Aeronautics Branch of the Department of Commerce, insofar as they relate to airport engineering and construction, have joined into one group to undertake the solution of the problems involved in one of the most urgent needs of airport development and air transportation—adequate drainage and surfacing for airports.

"The absence of uniform and thorough applications of adequate drainage and surfacing for airports has been responsible for accidents to planes in landing

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and taking off from airports and landing fields; for delays and interruptions in departures and arrivals of aircraft, and has involved the wastage of thousands of dollars in time and money in connection with airport or landing field projects.

In addition to calling for the application of the established principles of highway and drainage engineering the solution of these problems involves a number of considerations more or less peculiar to aircraft operations."

The three organizations have designated representatives to serve on a committee organized by Clarence M. Young, Assistant Secretary of Commerce for Aeronautics, and known as the "Committee on Airport Drainage and Surfacing," which will undertake, at once, a comprehensive and thorough study of the problems involved; collect and correlate available information and experience and present its findings and recommendations in a report that will serve as a working-tool in the hands of engineers engaged in the development of air terminals, and also will meet the constantly increasing demand for information on this subject. The committee is under the chairmanship of Harry H. Blee, Director of Aeronautic Development, Department of Commerce, and includes also; for the Dept. of Commerce, A. Pendleton Taliaferro, Jr., and John E. Sommers; for the American Road Builders' Ass'n., Wm. A. Van Duzer, C. N. Conner, Col. C. E. Myers, Henry H. Wilson and Chas. M. Upham; and for the American Engineering Council, W. W. Horner, Archibald Black, Perry A. Fellows, C. A. Hogentogler and James H. Polhemus.

Eliminating Phenolic Tastes and Odors*

By Earl Devendorf

Associate Director, Div. of Sanitation, New York State Dept. of Health

THE water supply intakes of the city of Buffalo and of the Western New York Water Company, which latter supplies communities outside of and adjacent to the city of Buffalo, are located in the relatively shallow end of Lake Erie. While the water supplies are normally relatively clear and not seriously polluted, studies made by the State Department of Health have shown that, following heavy wind storms, polluted shore waters containing phenolic or taste-producing wastes are carried to the water-supply intakes and have resulted at times in the occurrence of seriously objectionable tastes in these water supplies.

An investigation of those manufacturing plants and industries known to be discharging large quantities of phenolic wastes into Lake Erie or its tributaries in the vicinity showed that, of the three large producers of such wastes, only one was provided with a waste treatment plant. After a study of the occurrence of objectionable tastes in the water supplies of Buffalo and vicinity had indicated that the discharge of phenolic wastes was affecting these water supplies, the State Health Department conferred with the officials of the industries involved and explained the situation and the need for its correction. At the request of the Department the industries took immediate steps to either provide for treatment of the wastes or eliminate their discharge into the lake and its tributaries.

The largest industry involved installed a treatment works costing some $150,000, which has now been in operation approximately six months. The other large industry involved has eliminated the discharge of its phenolic wastes by pumping them into drilled wells penetrating a salt stratum. This waste disposal system has been in operation over a year and, so far as is known, this method of disposal of the wastes has not affected any water supply.

Notwithstanding the very excellent cooperation received from the industrial concerns involved, objectionable tastes in these water supplies have occurred occasionally, although such tastes have been of less intensity and duration than formerly was the case. These occurrences have followed, as formerly, periods of storms and sudden and considerable fluctuations in the lake levels, which result in carrying polluted shore water to the water supply intakes.

As a result of recommendations made by the State Health Department, the water supply authorities have undertaken studies of a number of methods of treatment of their water supplies to prevent the occurrence of objectionable tastes. These studies included the treatment of the water by potassium permanganate, excess chlorine and by the ammonia chlorine method. The authorities in charge of one of the water supplies affected arranged for the treatment of their supply by the use of potassium permanganate, but has recently changed to the ammonia chlorine method.

Although this treatment has been successful in preventing objectionable tastes in water supplies similarly affected in other states, this is the first supply to undertake this treatment in New York State and the results of the treatment are being awaited with a great deal of interest by the State Department of Health.

*Abstract of paper before New York Branch, American Water Works Association.

How Suffolk Treats Its Gravel Streets

(*Continued from page 34*)

Due to the fact that on some of the streets treated in 1924, we used a covering material varying in size from ¼-inch to 2½ inches, which left the surface very rough, and wishing a smooth appearing surface, we treated about twenty per cent of them the following year with about one-third gallon of Tarmac P and thirty pounds of coarse sand. The remainder of the work has never been retreated.

We have continued to construct gravel streets from year to year in our residential sections, following the practice of allowing them to weather over the winter and then giving them a double surface treatment of cold and hot tar, as previously explained. However, as the amount of work increased, we deemed it advisable to buy a small distributor to apply the tar.

For the first time in six years, several of our gravel streets will probably have to be retreated this summer.

Up to the present time we have about 130,000 square yards of gravel-treated streets, costing approximately ninety cents per square yard to construct, which includes the cost of the gravel, grading and surface treatment.

The work was done by city forces with the exception of the curb and gutter work, which was done by contract at a cost of eighty-eight cents per linear foot.

These streets have proved entirely satisfactory for our residential sections, and have solved the problem of furnishing these sections with good streets at a low cost, and which have required little maintenance.

Where good gravels are available locally this method seems to be one of the most economical ways to construct good serviceable streets at a low cost.

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Get all the remarkable facts about these new Goodyear Balloon Truck Tires now, from your Goodyear Truck Tire Service Station Dealer. He is equipped to recommend the right tires for any hauling job.

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Acquisition, Maintenance and Operation of Airports

(*Continued from page 42*)

acquire or lease real property for such purpose or set apart and use property already owned, but not until a proposition therefor fixing the amount to be expended has been submitted under the town law at a town meeting and adopted by a majority vote. The article does not apply to a county wholly within a city (§ 350).

The property may be acquired by purchase or by condemnation. The money required may be raised by the sale of municipal bonds, a proposition therefor to be voted upon if that is a prerequisite to the issue of bonds of such municipality for public purposes generally. (§ 351.)

Provision is made for the equipment, maintenance and operation of such airport and the adoption of regulations and establishment of fees and charges for its use. (§ 352). The approval of the board of estimate, if any, is required. (§ 353.)

Two cities in the same county or adjoining counties, or two villages in the same county, may jointly acquire such real property and establish and maintain an airport for such municipalities jointly. (§ 353-d.)

A controversy was submitted to the New York Appellate Division in which the plaintiff sought to restrain the issue of $120,000 bonds which the city of Utica had authorized under the statute for the purchase of land for an airport. The Appellate Division Hesse v. Rath, (1928) 224 App. Div. 344 determined the controversy in favor of the city.

The question in the case was whether the establishment of an airport is "a city purpose" within the meaning of section 10 of article 8 of the State Constitution, which provides: "Nor shall any such county, city, town or village be allowed to incur any indebtedness except for county, city, town or village purposes."

The court said that the Legislature, by the enactment of the statute, had determined that the establishment of an airport is "a city purpose;" and in determining the constitutionality of the statute this should be given great weight and the action of the Legislature should not be annulled unless the purpose appeared clearly to be one not authorized.

"In the determination of the question presented," the court continued, "we start with the presumption that the statute is constitutional and valid, (People ex. rel. Kemmler v. Durston, 119 N. Y. 569). What constitutes 'city purpose' within the meaning of the constitutional provision cannot be stated with exactness. Something that fifty years ago could not have been held to be 'a city purpose' may today be clearly authorized by the Constitution. 'The question of what is a public purpose is a changing question, changing to suit industrial inventions and developments and to meet new social conditions. Law is not a fixed and rigid system, but develops, a living thing, as the industrial and social elements which form it make their impelling growth.' (City of Tombstone v. Macia, 30 Ariz. 218, 245 Pac. 677). The provision must be construed in view of conditions existing at the time when the question is raised. A statute held to be unconstitutional at one time may, at a future day, in view of changing conditions and new light upon the subject, be held to be constitutional. (People v. Charles Schweinler Press, 214 N. Y. 395.) The words 'a city purpose,' as used in the Constitution, have been construed by many decisions. In Sun Printing & Publishing Association v. Mayor (152 N. Y. 257) it was said: '. . . the purpose must be necessary for the common good and general welfare of the people of the municipality, sanctioned by its citizens; public in character and authorized by the Legislature.' (See, also, Matter of Chapman v. City of New York, 168 N. Y. 80.)

"We may take judicial notice of the fact that aviation is no longer an experiment. Large sums of money have been expended and are being expended by municipalities in providing suitable airports. Commercial and passenger lines have been established for the transportation of passengers, mail and express. Railroads have established schedules in connection with air transportation companies for the more rapid transportation of passengers and valuable express, and the government has availed itself of air transportation in carrying mail. In view of such extensive development of aviation and the purposes for which air transportation is used, we believe that the Legislature was justified in its determination that the building of an airport is 'a city purpose' as is the building of a railroad, a bridge, or a dock. At least, we are unable to say that it is not 'a city purpose' and, therefore, the determination of the Legislature is valid and constitutional."

This was affirmed by the Court of Appeals, 249 N. Y. 436, 164 N. E. 342, (December 7, 1928). That court said: "A city acts for city purposes when it builds a dock or a bridge or a street or a subway. Its purpose is not different when it builds an airport. Aviation is today an established method of transportation. The future, even the near future, will make it still more general. The city that is without the foresight to build the ports for the new traffic may soon be left behind in the race of competition. Chalcedon was called the city of the blind, because its founders rejected the nobler site of Byzantium lying at their feet. The need for vision of the future in the government of cities has not lessened with the years. The dweller within the gates, even more than the stranger from afar, will pay the price of blindness."

In proceedings to condemn land for a municipal airport, under the New York statute, the common council was held to be the judge of the amount of land needed. In re Airport or Landing Field of City of Utica (February 21, 1929) 234 N. Y. Supp. 668.

Under Oregon Laws 1925, p. 162, § 7091, authorizing any incorporated city or town to appropriate any private real property for the general use and benefit of the people of said city or town for an aviation field or park, the Oregon Supreme Court holds, McClintock v. City of Roseburg, 127 Or. 698 (January 8, 1929), 273 Pac. 331, that a city may issue bonds for the establishment and maintenance of an airport, such a purpose being public rather than private. "What is a public use is not capable of an absolute definition. A public use changes with changing conditions of society, new appliances in the sciences and other changes brought about by increased population and modes of transportation and communication. We cannot close our eyes to the great growth in the use of flying machines during the past decade. This growth has been especially noticeable during the last two or three years. We must take notice that a large quantity of mail is being daily transported into the various parts of the country. Expressage and even freight is being transported by aeroplane in large and rapidly increasing quantities. Transportation by air appears to be increasing so rapidly that we may confidently expect that soon a large portion of the mail

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and express will be transported by aeroplane. An airport owned by the city open to the use of all aeroplanes is for the benefit of the city as a community, and not of any particular individuals therein. It is therefore a public enterprise. Aeroplanes travel the 'trackless air.' The only way an aeroplane company could acquire a monopoly would be through monopolizing the airport. It would seem, therefore, that airports may be properly owned and controlled by a municipality or other public corporation. Such has been the holding of all the courts passing upon the question directly."

The Oregon court in similar cases involving the same principle by analogy also supports the power and right of a city to maintain at public expense a park for runways and other conveniences for aeroplanes.

A landing field for aircraft is a public utility. The Ohio Legislature, by section 3939 of the General Code has given authority to municipalities within the state "for purchasing or condemning land necessary for landing fields, either within or without the limits of a municipality, for air crafts and transportation terminals and uses associated therewith or incident thereto, and the right of way for connections with highways, electric, steam and interurban railroads and improving and equipping the same with structures necessary or appropriate for such purposes." If such a landing field were not a public utility, the Ohio Supreme Court says, the Legislature would have no power to make provision for the purchase and condemnation of lands for such purpose.

It appeared in this case that the council of the city of Canton had adopted an ordinance authorizing and empowering the executive officers of the city to purchase a certain described parcel of land as a site for a municipal airport, having previously adopted an ordinance providing for an issue of bonds to provide funds therefor. The suit was in mandamus to compel the city authorities to submit the later ordinance to a referendum of the people. The defendants urged that the ordinance was not the initial legislation on that subject, and that it was therefore not subject to a referendum under the statute. The relator contended that the establishment of a landing field for aircraft is the establishment of a public utility, and that therefore every ordinance pertaining to that subject is subject to a referendum under section 8 of article 18 of the Ohio Constitution. Sustaining this contention, the court allowed the writ.

Right to Sublet Airport

In the following case the Kansas Supreme Court denied the right of a municipality which had leased land for a municipal airport to sublet the land with the airport buildings erected by the municipality thereon to a private enterprise where no such right was expressly conferred by statute.

Under the Kansas statute, R. S. 3-110, the city of Coffeyville leased a convenient tract of 140 acres for a municipal airport. The lease term was five years, and the rental was $1,000 per annum, with an option to buy the land at $13,500, and there was an additional stipulation that if that option were exercised, the rents paid would be credited on the purchase price. The lease was executed February 14, 1928. On July 15, 1928, the city sublet its airport to a flying school, or an aeronaut practicing his profession under the name of such school, for five years at $50 per month, the rent to begin after the city had erected four hangars, with various provisions as to rates for service and the respective rights of the parties.

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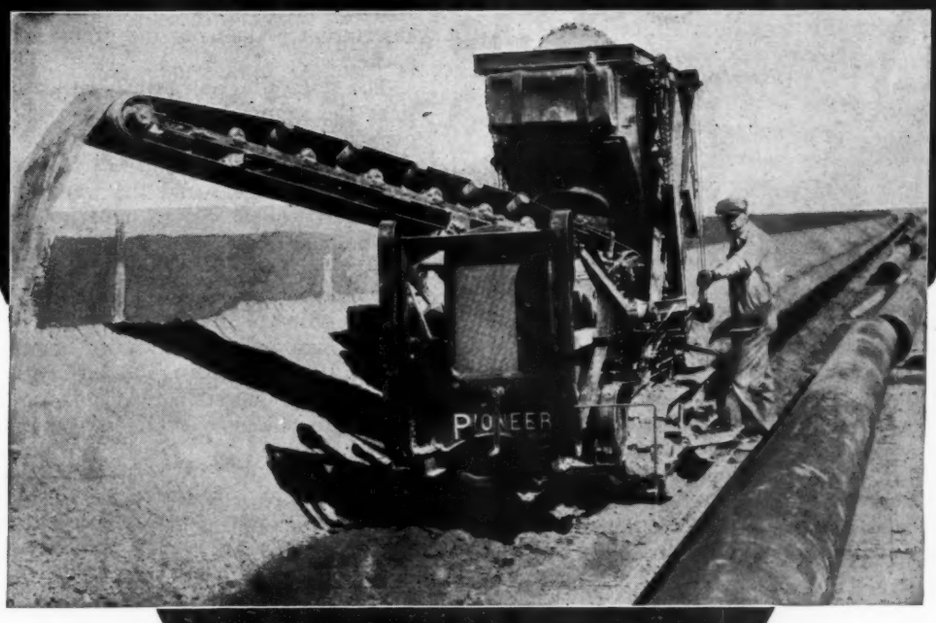

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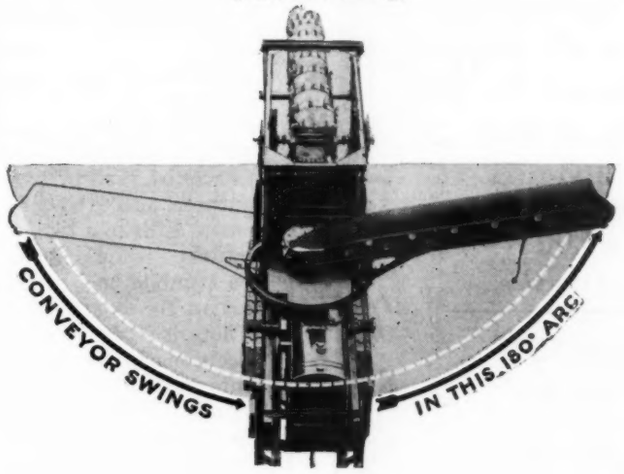

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A proceeding in quo warranto was brought by the State on relation of the county attorney to determine whether the city may sublet its airport to a private individual and authorize him to operate it for the convenience of all aviators who choose to use it on reasonable terms, and to put the profits, if any, in his own pocket.

The state alleged against the lease various illegalities—the granting of exclusive rights over the entire airport to the lessee and authorizing him to fix prices for the services of the airport and for the transportation of passengers and the want of corporate power on the part of the city to sublet its airport.

The city replied, in part, that it was not its intention by the lease to surrender its right to the supreme management and control and the supervisory care over the operation of the airport for the public good.

The Kansas Supreme Court, State v. City of Coffeyville, (1929) 127 Kan. 663, 274 Pac. 258, regarded as the principal question presented whether the city has corporate power to sublet its municipal airport to a private individual. No such right is expressly conferred by statute. The court therefore applied its rule for the construction of corporate powers of cities, frequently followed by it as follows: Municipal corporations are creations of law and can exercise only powers conferred by law and take none by implication. In making contracts they must act within the limits of and observe the regulations prescribed. Persons contracting with such corporations must inquire into their powers at their peril.*

The fact that the unauthorized power which the official board or governmental agency assumes to exercise may be a good stroke of business will not justify it. Neither the general powers of regulation and contract as to the real property of a municipality, given by Kansas R. S. 12-101, nor any other statute, it is held, can be interpreted as conferring upon the city the corporate power to sublet its municipal airport, nor to confer upon a private individual, as lessee of the city, the exclusive privilege of managing the municipal airport for his private profit; and the fact that the lease contemplates that the lessee's charges must be reasonable, and that the aviation services must be open to all aviators alike, or (a syllabus to the opinion states) the fact that the city does not yet find it practicable to conduct and manage the airport itself, will not excuse the city's exercise of a corporate power for which there is no statutory authority.

Enabling Statutes

Within the past three years a majority of the states have enacted statutes enabling municipalities, singly or in cooperation, to establish, maintain and operate airports within or without their corporate limits and to acquire land or use land already acquired for that purpose, and to issue bonds in furtherance of that purpose. Bills to a like effect are pending in other Legislatures. Some of these statutes declare the purpose to be a public one. In some, cooperation with individuals in the operation of the airport is provided for. There is little doubt, in view of the unanimity of the decisions in the cases so far before the courts on the subject, that the validity of such statutes will be maintained. The extent to which the municipalities may avail themselves of the power is, of course, a matter for conjecture.

*Since this article was written, the New Jersey Supreme Court has decided, Stern v. Mayor, etc., of Jersey City, 150 Atl. 9, that, under the New Jersey statute, P. L. 1929, c. 26, authorizing the leasing of land acquired for airport purposes to private persons, firms or corporations, the lease need not be made to the highest bidder under P. L. 1927, c. 87, p. 160, even assuming it to be a sale of an interest in the land.

Operation of Glass-Covered Sludge Beds

(*Continued from page 32*)

cent. The complete data relative to these test dryings are contained in the accompanying tables.

The year 1929 was remarkable at Marion for the number of cloudy days experienced. Of the 314 days sludge was on the beds, only 122 were clear or partly clear. Weather Bureau data give only 74 clear days during the year. Furthermore, the precipitation for the year was 54.03 inches, an increase of 15.4 inches above the annual average. From this it may be gathered that in 1929 the drying of sludge at Marion on open beds would have been rather difficult.

The beds used in the test dryings had been resanded. We were unable to secure as good a sand as had been used originally and in consequence the drainage apparently was not as effective as it had been when the sand was coarser and better graded. With better sand the results might have been even more favorable.

Conclusions Drawn from Marion Experience

From the records of the routine plant operation and from the results of the special test dryings recorded above, the following conclusions regarding sludge disposal may be drawn from our experience at Marion.

With a sludge from 7 to 7.5 per cent solids, it is possible with applications of from 8 to 10 inches depth to secure 20 dryings in a calendar year, for a total disposal of 0.58 cubic yard wet sludge per square foot of drying area.

The quantity of digested sludge 7 to 7.5 per cent solids averages 6.1 cubic yards or about 1200 gallons per million gallons of sewage treated.

An increase in the solids content of 1 per cent and a slight increase in depth of application not to exceed 12 inches will not greatly affect the drying period, under favorable conditions. The quality of the sludge and the condition of the bed have an important bearing in this respect.

The covered sludge drying bed affords a practicable, feasible and most economical method of sludge drying where sand beds are used.

Cost of Sludge Drying Beds

The cost of glass-covered sludge drying beds varies appreciably, depending upon available sand and other factors. From information now available it appears that the cost will lie between $2.50 and $3.00 per square foot, of which roughly two-thirds may be regarded as the price of the covering.

Future Possibilities

The need for more complete data on the drying of sludge is apparent. Sludge disposal is still the vital issue in sewage treatment. More investigational work

Test Dryings on Glass Covered Sludge Beds

Table No. 1—Bed No. 3—1929

	Applied Sludge					Removed Sludge							
Test Number	Date Applied	Depth in Ins.	Per Cent Moisture	Per Cent Solids	Per Cent Volatile Solids	Date Removable	Date Removed	Depth in Ins.	Per Cent Moisture	Per Cent Solids	Days On Bed	Days Clear	Temp. - °F In Greenhouse Max.	Temp. - °F In Greenhouse Min.
1	Jan. 1	8.0	93.0	7.0	56.2	Feb. 12	Feb. 13	4.0	77.3	22.7	43	7	82	–6
2	Feb. 25	7.75	91.5	8.5	58.7	Mar. 24	Mar. 25	2.7	68.0	32.0	28	8	96	12
3	Mar. 29	8.5	92.5	7.5	58.2	Apr. 12	Apr. 17	2.75	71.9	28.1	19	2	100	34
4	Apr. 19	9.0	92.4	7.6	53.3	May 3	May 3	4.0	68.0	32.0	13	5	95	32
5	May 5	7.5	90.3	9.7	54.8	May 16	May 17	3.4	67.0	33.0	12	4	102	33
6	May 18	10.0	92.8	7.2	54.8	May 31	May 31	3.6	72.3	27.7	12	6	118	34
7	June 1	10.1	93.0	7.0	55.0	June 14	June 14	4.0	65.0	35.0	13	7	106	36
8	June 15	10.1	92.8	7.2	55.2	June 25	June 25	4.1	63.0	37.0	9	5	114	50
9	June 28	10.0	93.3	6.7	53.2	July 5	July 13	3.5	54.7	45.3	14	3	110	45
10	July 16	10.0	93.0	7.0	49.2	July 28	Aug. 7	3.3	47.5	52.5	21	15	118	44
11(a)	July 30	10.1	93.8	6.2	54.6	Aug. 10	Aug. 12	4.1	60.8	39.2	10	9	113	44
12(a)	Aug. 13	10.0	93.0	7.0	52.2	Aug. 22	Aug. 23	3.8	68.0	32.0	9	6	110	43
13	Aug. 27	10.8	94.7	5.3	54.6	Sept. 4	Sept. 5	4.0	70.0	30.0	8	7	120	42
14	Sept. 7	10.2	93.8	6.2	53.8	Sept. 13	Sept. 16	4.1	72.0	28.0	8	3	112	34
15	Sept. 17	10.0	92.3	7.7	49.6	Sept. 29	Sept. 29	4.0	74.0	26.0	11	8	126	32
16	Sept. 30	10.8	92.9	7.1	48.9	Oct. 17	Oct. 18	4.0	69.0	31.0	17	10	104	33
17	Oct. 20	10.5	93.5	6.5	54.1	Nov. 10	Nov. 11	4.0	77.5	22.5	21	7	114	24
18	Nov. 12	8.3	92.3	7.7	49.6	Nov. 30	Dec. 2	2.5	70.0	30.0	19	5	104	8
19	Dec. 3	8.0	92.3	7.7	48.0	Dec. 15	Dec. 15	3.4	74.8	25.2	12	1	100	12
20	Dec. 15	8.0	92.3	7.7	54.2	Dec. 30	Dec. 31	4.0	78.0	22.0	15	0	100	12
Total		187.65	1855.5	144.5	1068.2			73.25	1368.8	631.2	314	118		
Average		9.4	92.8	7.2	53.4			3.66	68.4	31.6	16	6		

(a)=Bed No. 5

Table No. 2—Bed No. 4—1929

	Applied Sludge					Removed Sludge							
Test Number	Date Applied	Depth in Ins.	Per Cent Moisture	Per Cent Solids	Per Cent Volatile Solids	Date Removable	Date Removed	Depth in Ins.	Per Cent Moisture	Per Cent Solids	Days On Bed	Days Clear	Temp. - °F In Greenhouse Max.	Temp. - °F In Greenhouse Min.
1	Jan. 1	7.25	93.2	6.8	56.2	Feb. 10	Feb. 13	3.5	77.0	23.0	43	7	82	–6
2	Feb. 25	8.0	92.5	7.5	58.7	Mar. 23	Mar. 26	3.1	66.8	33.2	28	8	96	12
3	Mar. 29	7.2	91.8	8.2	58.2	Apr. 12	Apr. 17	2.5	68.3	31.7	18	2	100	34
4	Apr. 19	8.5	92.3	7.7	53.3	Apr. 30	May 1	3.5	70.0	30.0	12	5	95	32
5	May 5	7.5	92.4	7.6	54.8	May 16	May 16	2.8	67.0	33.0	10	4	102	33
6	May 18	9.8	91.6	8.2	54.8	May 31	May 31	3.2	68.6	31.4	12	6	118	34
7	June 1	10.2	92.5	7.5	55.0	June 14	June 14	4.1	66.0	34.0	12	7	106	36
8	June 15	10.1	94.4	5.6	55.2	June 25	June 26	3.9	62.8	37.2	5	6	114	50
9	June 28	10.5	93.7	6.3	53.2	July 13	July 13	3.5	60.8	39.2	14	3	110	45
10	July 16	10.4	93.1	6.9	49.2	July 28	Aug. 12	2.5	29.5	70.5	26	19	118	44
11(a)	July 30	10.3	93.8	6.2	54.6	Aug. 10	Aug. 12	3.5	60.0	40.0	12	9	113	44
12(a)	Aug. 13	10.2	93.0	7.0	52.2	Aug. 22	Aug. 22	4.0	60.5	39.5	8	6	110	43
13(a)	Aug. 27	10.3	94.5	5.5	54.6	Sept. 4	Sept. 9	4.1	65.0	35.0	12	7	120	42
14	Sept. 7	10.0	93.7	6.3	53.8	Sept. 13	Sept. 14	4.1	72.0	28.0	6	3	112	34
15	Sept. 17	9.6	92.6	7.4	49.6	Sept. 27	Sept. 27	4.0	75.0	25.0	9	7	126	32
16	Sept. 30	10.8	93.2	6.8	48.9	Oct. 17	Oct. 18	4.3	67.9	32.1	17	10	104	33
17	Oct. 20	10.0	93.5	6.5	54.1	Nov. 7	Nov. 9	4.0	78.0	22.0	19	7	114	24
18	Nov. 12	8.0	92.3	7.7	49.6	Nov. 30	Dec. 2	3.5	70.0	30.0	19	5	104	8
19	Dec. 3	8.0	92.5	7.5	48.0	Dec. 15	Dec. 15	3.3	74.0	26.0	12	1	100	12
20	Dec. 15	8.0	92.3	7.7	54.2	Dec. 30	Dec. 31	4.0	79.0	21.0	15	0	100	12
Total		184.65	1858.9	141.1	1068.2			71.4	1338.2	661.8	313	122		
Average		9.23	92.9	7.1	53.4			3.57	66.9	33.1				

(a)=Bed No. 6

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should be carried on in connection with routine operation, and data regarding sludge disposal should be kept on special forms particularly designed for the purpose. A sample of the form used at Marion is attached hereto.

No doubt, the future will see many refinements and improvements in design. This applies not only to structural improvements and protection against weather and fumes, but also to the design of the sludge beds themselves with a view to securing the most effective means of drainage and evaporation. Glass-covered sludge drying beds will undoubtedly increase in favor and without question will be improved in both design and construction. With separate sludge digestion and gas collection on a well established basis, it does not seem a far step toward utilizing some of the gas for the artificial heating of sludge beds.

It is our firm conviction that the next five years will show an even more decided advance in the field of drying sludge under glass, than have the past five years, during which time this method has developed from one often looked upon as of doubtful practicability to one of assured future as an important link in the advance of the art of sewage treatment.

Water Department Maps and Field Records

(*Continued from page 33*)

leaf binder, so that revised sheets may replace those made obsolete from time to time. As a guide to the size needed, with a scale of 20 feet to the inch, a sheet with available width inside margins and binding edge of four inches minimum will allow for eighty feet, giving over one hundred feet on the long dimension. With this scale it is possible to show considerable detail for the intersections, and still be able to give the measurements to the valves clearly without confusion.

Valves are located by measurement to two or more permanent points; by measurement from the nearest corner, along the curb or property line to a point opposite the valve, and the offset from there to the valve; or by a permanent mark on a building opposite the valve and the distance out to the valve. A dip needle may be used to supplement these where the top of the valve box does not show on the street surface.

The first is perhaps the most usual and undoubtedly the most accurate; but finding the intersection of two arcs swung by a tape is sometimes difficult at a busy intersection, and points thought to be premant may prove not to be. The second method is good if the main lies near the curb, and has the special advantage that generally a sketch is unnecessary—an important matter in a large city, where thousands of valves have to be located; but if the main is well out into the roadway, the offset estimated to be perpendicular to the curb may not hit the valve.

Locations should be standardized throughout the system—that is, if measurements are taken from the curb line in some sections, the curb line should be used throughout. It is probably better to use the property line for such measurements, since curb lines are more apt to be moved than property lines.

Permanent marks on buildings is a good plan in some cities, but not where the buildings set back 25 feet or more from the property line. One city uses, for a marker on buildings, a composition brass casting which has blanks on which to stamp the distance out and size of valve.

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GOHI
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PURE IRON - COPPER ALLOY
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(Meet copper-bearing pure iron requirements in all accepted specifications for corrugated metal culverts.)

Corrugated Culverts

Installed Between Sunup and Sundown

KEEP the roads open — lower your drainage costs. In addition to unquestioned permanence, GOHI Corrugated Culverts offer the practical advantages of easy handling and quick installation.

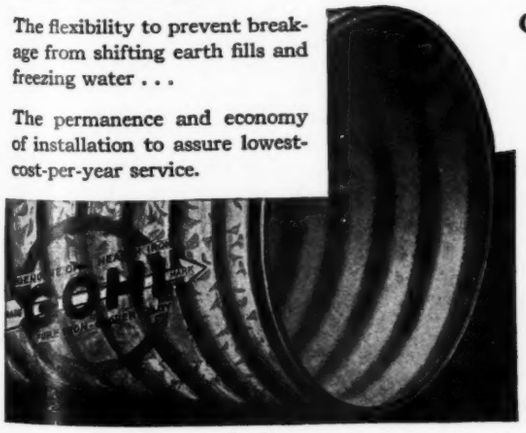
A GOHI Corrugated Culvert may be installed in less time and at lower cost than any other type of culvert. No heavy, expensive machinery needed. No delays. Simply dig the ditch, lay culvert in position, backfill and resurface — the job's done. Quick, Sure, Safe.

GOHI Corrugated Culverts are made of Genuine Open Hearth Iron, pure iron-copper alloy. Metallurgical tests and more than twenty years of actual service prove that this material offers greater resistance to corrosion than any present-day culvert metal. Get all the facts — figure all the costs — you'll specify GOHI Corrugated Culverts.

GOHI Corrugated Culverts have the strength to stand up under all traffic conditions . . .

The flexibility to prevent breakage from shifting earth fills and freezing water . . .

The permanence and economy of installation to assure lowest-cost-per-year service.



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Symbols

In indicating mains on the map, the author recommends using the conventional signs of the National Board of Fire Underwriters. The use of dots and dashes as a rational method of indicating the size, he says, make slow drafting; while different colors used for the same purpose cannot be transferred to a blue print, and fade until brown can not be distinguished from red, and blue, green and yellow look alike.

The Underwriter's conventions are well known, the different kinds of lines are not complicated, there is no difficulty in blue printing, and while it is necessary to label the larger sizes of pipe, by drawing the different sizes a little heavier as they become larger, it is not difficult to get the size without trouble.

For clearness it is better to make general maps in skeleton form rather than to use the street lines. This applies, of course, to the smaller-scale maps on which it is not necessary to record measurments. Where two or more mains are laid in the same street, by using the skeleton method, each main can be shown sufficiently separated from the others to give opportunity to show any cross connections or other detail which may need to be inserted, without danger that they will be overlooked because of the close proximity of the mains.

Valves are sometimes indicated by a circle or cross, but a short line across the main is simpler; and when this symbol is used a circle can be drawn around it to indicate special conditions, such as a closed boundary valve.

Dead ends should be definitely noted by means of a short arc of a circle drawn across the end. This is especially necessary where a main dead-ends just before meeting another main, as it is easy to mistake such a point for a slip on the part of the draftsman.

It is entirely possible and relatively inexpensive, when the tracings are new, to have made reproductions on tracing cloth which can then be used to record changes and additions, the master tracing being filed away and brought up to date once a year. When the working tracing begins to be illegible, a new reproduction can be made and the process repeated.

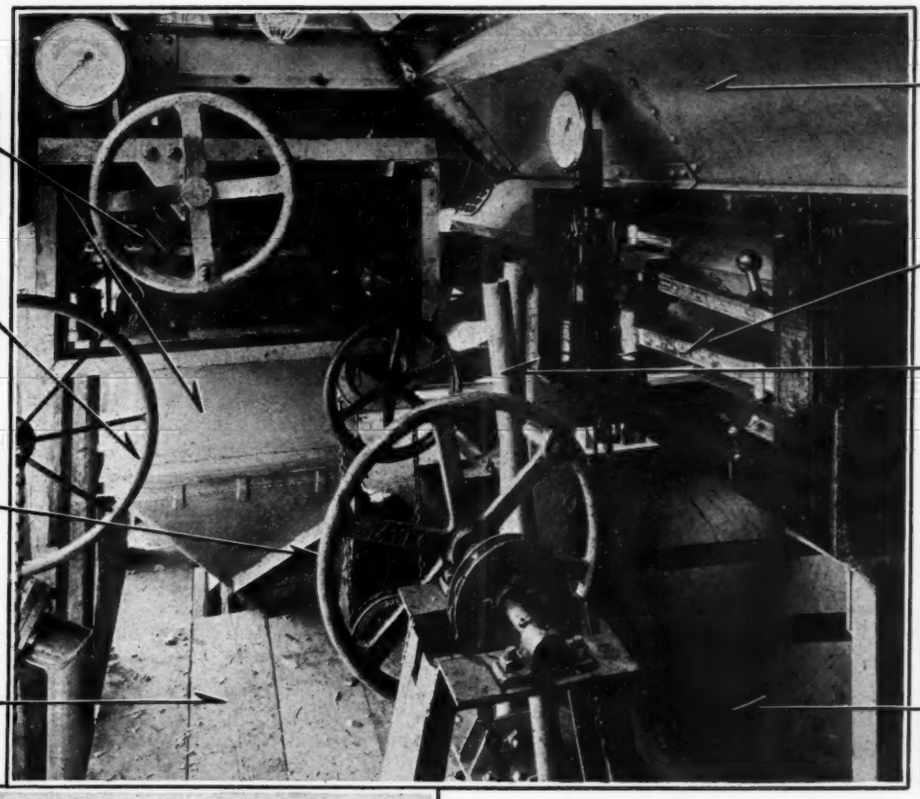
Filing Maps

The filing of maps and especially of tracings is of some importance. In a large plant where there are many drawings to take care of it is not hard to get proper files, but in a small water works where there are only a few maps to look after, a regular file for them would ordinarily not be warranted. It is much better to file maps flat, whether tracings or prints. Sometimes this is very inconvenient, and then it is better to fold the blue prints to letter size and file them in a regular letter filing cabinet or in a desk drawer. It is important to keep tracings clean and dry. If they get damp, the surface becomes opaque, and dust, if it has a chance, will work into them and cause the same result. Probably the most simple method of taking care of a small number of tracings is by storing in tin cans which are made for the purpose. When they are rolled, many people believe that it is better to roll them with the drawing side on the outside of the roll, instead of inside as is usually done. By this method, when a tracing is unrolled on a table it will lie flat of its own weight, where otherwise the ends will curl up and have to be held down. However they are rolled, they should never be rolled tightly.

Tracings of small intersection plats may best be filed in a loose-leaf binder similar to those which are used for the blue print copies used in the field. A complete index of these plats is essential.

The best part of a CENTRAL MIXING PLANT is BLAW-KNOX *design*

The convenient arrangement of the proportioning plant controls is a feature of the Northern States Contracting Company's central mixing plant at the Twin City Lock and Dam—on the Mississippi at Minneapolis.



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Mixer Discharge Control.

Control for Discharging weighed aggregates direct into mixer drum.

Operators platform convenient to all operating controls.

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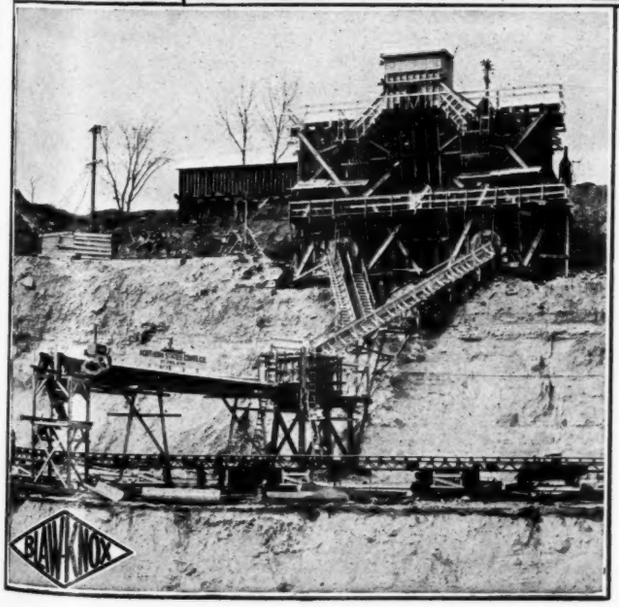

The twin Central Mixing Plant for the Northern States Contracting Company is an excellent illustration of the engineering ability which combines Blaw-Knox Equipment into an efficient concreting unit.

Two 250-ton Blaw-Knox Self Cleaning Steel Bins—Blaw-Knox Hopper Type Weighing Equipment feeding two 2-yd. mixers—and Blaw-Knox Bulk Cement Measuring Equipment.

Blaw-Knox Central Mixing Plant design is based on the experience gained in building concreting layouts for hundreds of construction jobs.

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STATIONARY AND PORTABLE PLANTS
ALL SIZES; ALL STYLES

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Other Records

While the measurements of service locations may be and sometimes are recorded on large scale maps, this does not give much if any information beyond the exact location on the ground. In order to keep proper records of the services, material as well as location, each service should have a separate sheet, which will give the date of laying, the street location, the measured locations of the corporation cock, and curb cock, the size of tap, the kind and quantity of material used, as well as any other items which may be pertinent to a specific service. These records are well adapted to card index filing, and may be filed either by streets or by serial number, the first being preferable. If the serial filing is used an index is also necessary to locate services by streets. In some cases a combination of the two is employed, the services being listed serially in a book, and a card index being maintained by streets.

Another system of field records which is not employed to the extent which it should be is that of valve operation records. Such a record should show the size, number of turns, direction of opening or closing, date of installation and make; and should have room for several operation notes, giving the date of each closing and opening and reason therefor. In almost all water works plants it is well known that the valves are not operated frequently enough to keep them in good working order. It is advisable to operate every valve at least once every year; but while some valves get fairly regular attention in the usual run of water works operation, many are not touched for many months at a stretch. The use of such a record will make it possible to see that these idle valves are in operating condition, ready for the time when they may be badly needed.

Los Angeles Meets Water Supply Crisis

(Continued from page 27)

An analysis of the safe yield, based on the 1923-1929 stream flow records, is as follows:

	Average Annual Flow Sec. Ft.
Natural stream flow for six-year period	266
Total installed capacity of wells, 272 sec. ft. Estimated time which wells may be pumped to full capacity—2½ years, or 40 per cent of six years; 40 per cent of 272 sec. ft.	110
	376

	Sec. Ft.	
Losses by reason of drying up springs due to pumping	35	
Channel and evaporation losses	45	
Local uses in Owens Valley	10	
		90
Net available at Haiwee reservoir		286
Additional supply obtainable by purchase of remaining Owens Valley lands		50
Total safe yield for Owens Valley		336
Safe yield from Mono Basin		135
Total dependable supply at Haiwee reservoir		471

The collecting conduit in the Mono Basin, from Leevining creek to Silver lake, will be about eleven miles in length, and probably will be of the open channel type. Diversion structures will be provided to intercept the flow of Walker creek and Parker

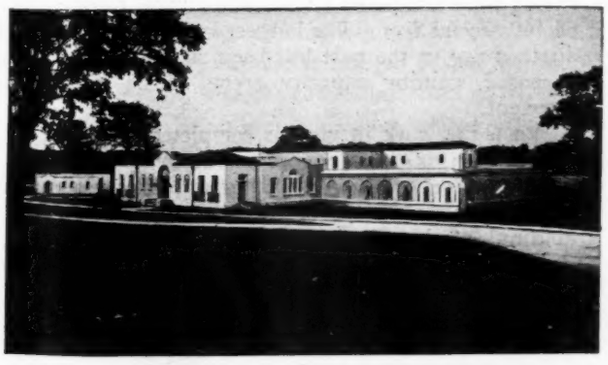
DORRCO

Gas Collection in Dorr Digesters

.... in separate sludge digestion sewage treatment plants.

In the separate sludge digestion plant of the Sanitary District of Aurora, Illinois, three gas collection type Dorr Digesters are used for digestion of sludge. Gas production at this plant has been more than sufficient for requirements. In the month of February the lowest temperature recorded in the Digester was 70° F. In April the average was upwards of 80° F.

In addition to regulating the temperature of the sludge in the Digesters, the heat generated by combustion of the gas is used for heating the main plant building, which consists of laboratory, office, locker rooms, pump station, garage and boiler rooms.



The plant at Aurora was designed by Alvord, Burdick & Howson, Chicago. In addition to the three Dorr Digesters, a Dorrco Bar Screen, Dorr Detritor and four Dorr Clarifiers are installed

Considering the fact that results similar to those at Aurora are being obtained at separate sludge digestion plants in all parts of the country, it is not surprising that this method of treatment is being selected so frequently by leading engineers for both large and small sewage treatment projects.

Ask our nearest office for a copy of the new edition of our booklet, "Modern Sanitary Engineering Practice" and also bulletin 6691, the Dorr Digester.

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The nozzles can be faced in any direction easily and quickly without disturbing the barrel. Just loosen the bolts of the swivel flange—turn the revolving head to where you want it—tighten up the bolts, and it's all set.

MATHEWS MODERNIZED HYDRANT **When broken is easily replaced without digging.**

Simply slip a tubular lug-wrench (which we can supply) down over the broken barrel, unscrew it, lift it out, and screw in the new, replacement barrel—*the whole job done in a jiffy, without digging or breaking the pavement.* This easy, money saving replacement—*an exclusive Mathews feature*—is a mighty important consideration in these times, with the rapidly growing number of hydrants broken by traffic accidents.

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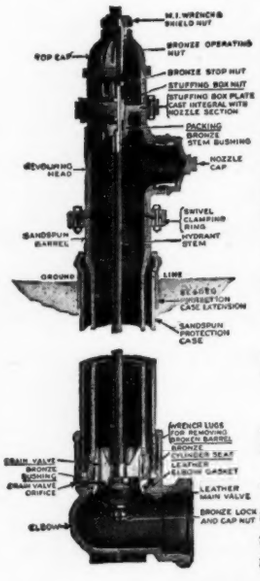

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creek; the other stream, Rush creek, emptying directly into Silver lake. The capacity of the lake will be increased to about 10,000 acre-feet by raising the surface elevation to about 7250 feet above mean sea level. Before the lake is filled with water the tunnel through the divide will be excavated, starting at a point near the bottom of the proposed storage basin, proceeding for eleven miles through the volcanic material typical of this region, and discharging into the headwaters of Owens River at about elevation 7097.

The enlargement of the present system to care for the added flow will require $11,100,000, including alterations to the aqueduct, increased storage facilities, and distribution changes. The existing aqueduct was designed to deliver 400 second feet at San Fernando, but the tunnels and siphons were given somewhat greater dimensions. This foresight is justified by present developments, as a little work done now at comparatively few points will increase the carrying capacity of the aqueduct to 440 second feet.

The major changes required are to the storage resorvoirs in and near the city of Los Angeles. The present storage capacity available for aqueduct water is 35,077 acre feet, which is dangerously small for carrying over the surplus winter flow for use the following summer. If no storage were added, by the time that water consumption reached the average annual rate of 400 second-feet there would be a reservoir deficiency of nearly 21,000 acre-feet. It is proposed therefore to enlarge the Chatsworth reservoir from 8218 acre-feet to 42,155 acre-feet, and to build a new reservoir of 30,000 acre-feet capacity. The lower San Fernando reservoir is already being enlarged from 14,672 acre-feet to 20,500 acre-feet, the work being done in anticipation of the need next year. These changes will add 69,775 acre-feet storage capacity to the present distribution reservoirs, making a total of 104,852 acre-feet. This is sufficient to supply the city for forty-nine days if the aqueduct supply should be shut off when the reservoirs are at their lowest level, basing the estimate on an average annual consumption of 440 second feet. The longest interruption to aqueduct service in the past has been sixteen days, so the proposed standby capacity seems to be more than sufficient.

When the work in view is completed, Los Angeles will be bringing water from mountain streams a mile and a half above sea level, through man-made and natural channels for over three hundred miles. The holdings of the city in land on the water sheds will amount to well over 200,000 acres, which will include five towns.

The estimated gross revenue of the department amounts to $10,000,000 annually, over forty per cent of which is to be used for bond requirements. The present per capita indebtedness for water service is $34.03, which will be increased by the sale of the new issue to $63.56. The water rates are relatively low, amounting to thirteen cents per hundred cubic feet, as compared to eighteen cents, the average of 183 representative American cities, as compiled by the American Water Works Association.

The acquisition of all property in private hands in Mono Basin and Owens Valley will have the effect of making the city the sole owner of this territory. It has been suggested that the city annex the area purchased, or form it into a water conservation district under the control of the city government. If annexation were to take place, Los Angeles would have a length of practically three hundred miles, measured in a straight line from one extremity to the other.

Master Construction Glass-Overs for Sludge Beds

Sewage Disposal Plant at Highland Park, Ill. It is a part of the chain of plants coming under the head of Chicago's North Shore Sanitary District.

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That is to say, solve two of the most difficult of solution. That of suitable-sized locations at not too distant points. Likewise, the controlling of the odors. By glassing over the sludge bed an increase from an average of 7 dryings a season to 20 is accomplished. This makes a reduction in size of beds possible.

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Technical Education by Correspondence

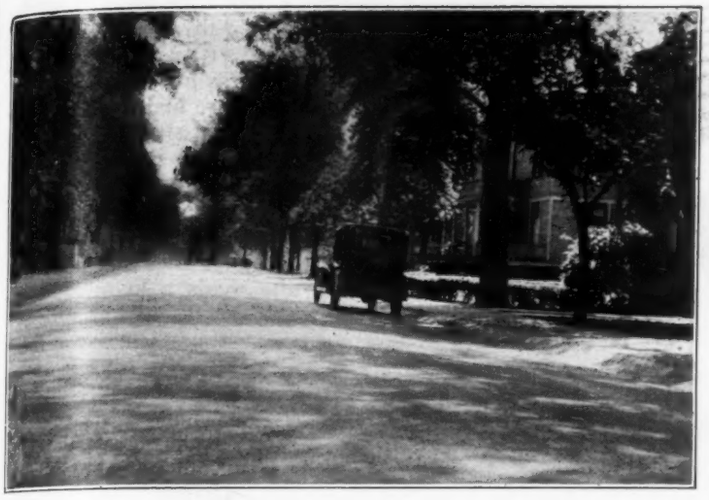
(Continued from page 23)

Home-study schools do not in any way replace our resident higher institutions of learning, with their well-equipped laboratories, large gymnasia and stadia, and the various social functions. But, to the man who has not the time or money to attend college, correspondence instruction offers an efficient service. Such instruction is particularly adaptable to the needs of the engineering employe whose work frequently takes him far from the city. It literally brings the college to his door, and he can make the most of the few hours he can spare from his work and essential diversions. He does not have to dress for school or spend time in traveling to and from school. He is not hampered by the general progress of the class, but can proceed as rapidly or slowly as his time or abilities will permit. Correspondence courses can be of special service to three classes of men who aspire to an engineering career, or who are already engaged in engineering work but are insufficiently trained for it.

First, there is the young man who wishes to get into engineering work but has no opportunity of attending college. If he enrols for a correspondence course, he can first acquire enough preparatory training for a start in a minor engineering position, and he can then continue his studies to fit himself for promotion. A complete course in engineering by correspondence offers him the training that he needs in order to succeed in the profession. The engineering courses offered by home-study institutions are designed more to meet the requirements of general practice than to parallel regular college courses. Therefore, they do not generally include higher mathematics, such as calculus or differential equations, and often devote but little space to the subjects that are mainly of cultural value and have no direct application in engineering. On the other hand, they usually cover more ground in the practical features and applications of the subjects they teach than is covered in the average college course.

Secondly, there is the older man who entered engineering work without any, or with insufficient, technical training. He usually acquires a certain amount of proficiency in his work and is a valuable man in a subordinate position, but his advancement to the higher positions is retarded or altogether barred because of his inadequate education in the fundamental principles of engineering. A correspondence course can help him make up this deficiency. His practical experience serves as a good foundation on which to base his theoretical studies, and he generally makes the most use of what he learns.

Third, there is the college graduate who, by force of circumstances, has gotten into a branch of engineering for which he was not specially trained. For instance, one who completed a mechanical engineering course may get into civil engineering, or one who majored in bridge engineering may later wish to specialize in sanitary engineering. Again, an engineering graduate may find a need for training in subjects not included in his course, such as business management, accounting, or commercial law. Usually these men can obtain the desired special training by means of correspondence courses. Fully 8 per cent of the students in the I. C. S. have had college training.



Warren Avenue, Hammond, Indiana. Asphaltic Concrete pavement.

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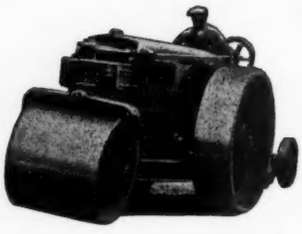

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The foregoing are only some of the ways in which a correspondence course can help the young and even the older engineer. Frequently, it is his only means of getting out of a rut. It trains him to make good use of his spare time and to prepare himself for whatever opportunities may present themselves to him. To the young engineer in civil service, the home-study course is often a help in brushing up on what he previously studied and in preparing himself for a promotion examination. The engineer who anticipates practice in foreign countries and wishes to study foreign languages, or one who needs a knowledge of fields allied to engineering, such as architecture or plumbing, will find homestudy courses most convenient for his needs.

There is quite a variety of courses offered by home-study institutions. In the large number of courses given by the I. C. S. are included courses in civil, structural, concrete, sanitary, highway, mechanical, electrical, and chemical engineering; architecture, building construction, and plumbing; advertising, salesmanship, accountancy, and industrial management; mining, navigation, agriculture, textiles, and commercial art; college preparatory, calculus, and various language courses. Other home-study institutions offer courses in such subjects as law, photography, music, and journalism.

The scholarship fees charged by the reliable correspondence schools are comparatively moderate. Thus, a complete civil-engineering course may cost less than the tuition fee for one year in a first-class university, like Columbia or Harvard. However, in selecting a correspondence course one should seldom be governed by the low fee, because that is frequently used as a bait by the unreliable schools that promise much and deliver little. Much has been done to eliminate unfair practices in the correspondence field, but unfortunately it is still infested by some unreliable schools, just as diploma mills have until comparatively recent times infested the field of medical education. Before enrolling for a correspondence course, one should investigate the reliability of the institution that offers it by ascertaining the extent of its educational experience and its general reputation for service to the student and, if possible, also the quality of its texts and the type of instruction that it furnishes.

Walkways

Walkways is the name applied by a South Carolina editor to sidewalks along country roads.

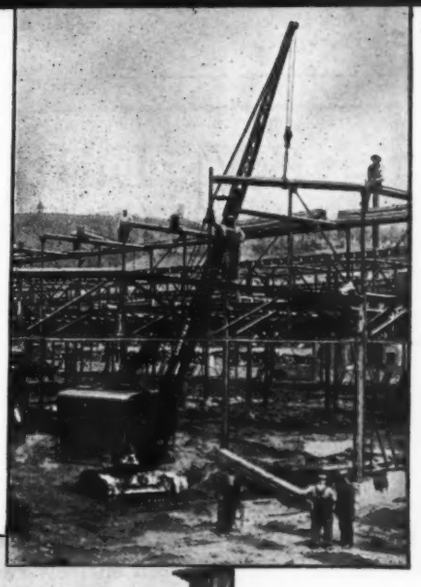
Near Detroit a state highway was widened, and in the process stretches of sidewalks were removed. Inasmuch as this was in rural territory, the walks were not replaced. No less than five persons have been killed and fifty injured since then. Plans are afoot to build sidewalks.

A survey shows that for the most part states and counties are not empowered to build rural sidewalks. It appears, then, that local communities themselves must, for the time being at least, build their own.

South Carolina Builds Roads

South Carolina recently awarded, at one letting, contracts for about 300 miles of concrete roads, divided into twenty-two sections; the first letting under the $65,000,000 bond issue voted last year. It is expected that contracts for 200 miles more will be let this year. The bonds are to be carried and retired by the gasoline tax of six cents a gallon.

UNIVERSAL-35



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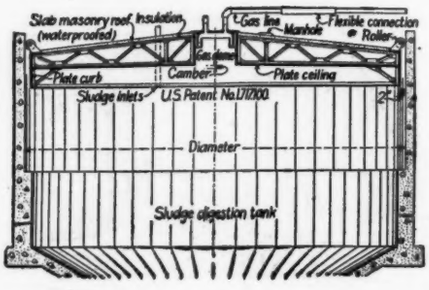

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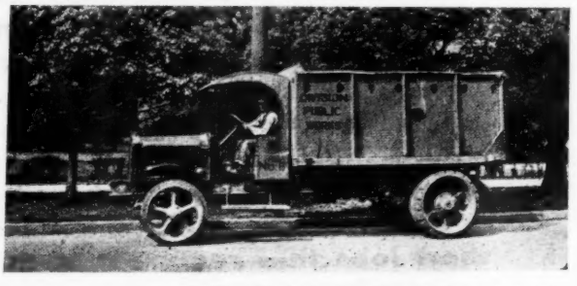
amounting to some forty acres in extent. This land, which is still an undrained swamp, in some cases has been filled to a height averaging 8 ft. above its original elevation. For fifteen years no charges were assessed the city for the dumping privilege except the release from the payment of taxes. It now costs the city an additional $2700 per year for the dumping privilege. While the dumping of garbage has been practically discontinued, this dump will still be needed to dispose of large tin cans, etc., collected by the city as well as incombustible trade wastes. The dumping of such materials can hardly be called a satisfactory solution of the problem, due to the nature of the fill resulting. Land filled with automobile bodies, wash-tubs, bottles, barrel hoops, wire, etc., is practically ruined for other purposes for many years pending the oxidation of the iron. A "salvaging" plant for the disposal of such materials will very probably some day be a part of the disposal facilities for waste in every city of moderate size. Land is "salvaged" indirectly rather than the materials handled.

"When temporary dumping spaces are available for contractors' dirt and street sweepings, the policing of such dumps presents a problem to the division, especially in the case of filling old drainage canals. It often happens that the place being filled has reached the desired grade and has been leveled off, but during the night or at times when no watchman is on duty, contractors and others will dump waste materials on the finished fill. Much work is wasted in having to go over such places repeatedly. The placing of 'No Dumping' signs does not correct the nuisance. The only satisfactory method of preventing such undesirable dumping that has been found is that of continual watching until all grading has been completed and the area planted in grass."



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"I believe," said Mr. Reilly, "that one of the essential needs for a better understanding of our work is the establishing of a complete system of cost accounting, covering every branch of work, even such details as the life of brooms, unit costs of feeding stock at each stable and separate cost data for every piece of mechanical equipment operated by the division. I believe that a great deal of progress has been made along this line during the present administration."

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EXCEPTIONAL cleanliness is the hygienic advantage of disposing of sewage by the activated sludge filtration method. No odors, no flies, no objectionable features.

Producing revenue is the economic advantage. The filtered solids, as they are or when further dried, make excellent nitrogenous fertilizer. From most of the stations listed it is being sold to the nearby farmers.

These cities, all equipped with Oliver United Sludge Filters, are handling their sewage problem hygienically and economically. They say to you "Use Activated Sludge Filtration".

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Protecting New Jersey Bathing Beaches

PRACTICALLY the entire length of the New Jersey shore line, more than one hundred miles, is literally one long bathing beach, where forty municipalities maintain one to ten bathing beaches each. Along the southern part of this shore line the sewage is disposed of in inland waters but from Beach Haven north it is discharged into the ocean.

Tests made several years ago by engineers of the State Department of Health, by means of floats placed at the end of one of the ocean sewer outfalls during each tide with the wind blowing in various directions, led to the following conclusions:

1. That the tank effluent travels either up or down the beach.

2. That the tank effluent travels in a very narrow stream which is probably not over twenty-five feet wide.

3. That the enormous quantity of ocean water rapidly dilutes or oxidizes the tank effluent.

4. That the surface film of water ultimately reaches the surf but only after it has become so highly diluted that it is of a better bacterial standard than surf water where bathers are active.

Last year the department adopted resolutions requiring seashore municipalities which discharge sewage into the ocean to first subject it to at least a minimum treatment of sedimentation and chlorination, and to discharge the settled and disinfected effluent through outfall pipes extending not less than one thousand feet from mean low water mark.

Much time is spent by engineers and inspectors of the department in seeing that the sewage of the ocean front municipalities is properly treated and disposed of. One of the principal tests recommended is the dye test, in which an aniline dye is placed in the effluent of the settling tank and the appearance of the dye in the ocean noted. If the dye appears at any point inside the 1,000 foot mark it indicates that the outfall is leaking. Additional information can be obtained from this test regarding the path of travel of the sewage.

The value of chlorination in addition to sedimentation has already been demonstrated at one seashore town, where surf samples indicated a B. coli content of 21 per cubic centimeter before and less than one in five cubic centimeters after the installation of chlorine treatment.

Prevention of Litter in Munich, Germany

The prevention of litter through the compulsory cooperation of the public finds its best example in Munich. There in the course of a year about 2,000 persons are required to pay one mark each as a reminder of their carelessness in allowing paper or other refuse to fall upon the street. The police officer who detects the offender collects the money and gives a receipt for it, keeping a record of the circumstances on a stub. He is thus accountable for the money he receives. If a citizen who is called upon to pay objects to doing so, the case is brought to a trial. Then the offender may be called upon to pay a fine of 50 marks or more. The money collected by the police officer is not regarded as a fine but as a warning.

Engineering Societies

July 9-11—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual convention at Cleveland, O. Secretary, George T. Seabury, 33 West 39th Street, New York.

Sept. 22-26—NEW ENGLAND WATER WORKS ASSOCIATION. Annual convention at Atlantic City, N. J. F. J. Gifford, Secretary, Dedham, Mass.

September 24-27 — INTERNATIONAL CITY MANAGERS' ASSOCIATION. Annual meeting at San Francisco, Calif. Executive Secretary, Clarence E. Ridley, 923 East 60th Street, Chicago, Ill.

October 6-11—SIXTH INTERNATIONAL ROAD CONGRESS at Washington, D. C. Secretary General, Thomas H. MacDonald, Washington, D. C.

October 7-10—AMERICAN ROAD BUILDERS' ASSOCIATION. International Exposition of Highway Equipment and Material at Washington, D. C. Secretary-Director, Charles M. Upham, National Press Building, Washington, D. C.

Oct. 9-11. — INTERNATIONAL ASSOCIATION OF STREET SANITATION OFFICIALS. Annual Conference at Louisville, Ky. A. M. Anderson, 100 No. La Salle St., Chicago, Secretary.

October 13-17—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual meeting at Richmond, Va. Secretary, C. W. S. Sammelman, 315 Commercial Building, St. Louis, Mo.

October 27-31—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting at Fort Worth, Texas. Executive Secretary, Homer N. Calver, 370 Seventh Avenue, New York.

Dec. 1-5. — ASPHALT INSTITUTE. Ninth Annual Conference at Memphis, Tenn. Asphalt Institute, 250 E. 43rd St., New York.

The American Water Works Association

The fiftieth annual convention of the American Water Works Association was most successfully held at St. Louis, Mo., June 2 to 6. Monday was given over principally to registration and to a round table session of the division of plant management and operation. There was also a meeting of the committee on Standard Methods of Water Analysis.

President Hinman opened the Tuesday morning session with a review of the history and growth of the association during its fifty years. Pictures of a number of the past presidents to the association were shown on the screen, and their contribution to the growth of the association was sketched briefly. Following this was a paper by C. R. Knowles of the Illinois Central Railway outlining the development of railway water supply practice.

There were two sessions Tuesday afternoon. The main session covered the following topics: Recent Progress in the Art of Water Treatment, which was a joint report by Abel Wolman, Wellington Donaldson, and Linn Enslow, presented by Mr. Wolman. This was discussed by W. W. Brush. The Purification of Highly Turbid Waters was covered by John D. Fleming of the St. Louis Water Works. It was, in general, a resume of St. Louis practice, covering basin capacity, sludge storage, the use of Dorr clarifiers, presedimentation, etc. This topic was discussed by prepared papers by F. C. Dugan, Kentucky State Sanitary Engineer, and by Dr. George F. Gilkison, Superintendent of Filtration, Kansas City, Mo. Recent Water Borne Disease Outbreaks were reported on by Abel Wolman and A. E. Gorman, and their paper was discussed by Robert Spurr Weston, of Boston. It was stated that during the past ten years, there were 226 known water borne disease outbreaks, not all typhoid, of course. Of these, 67 were due to untreated surface water, 54 to underground water, 42 to purification plant faults and 31 to distribution system failures.

This general discussion was continued by Joel Connolly, who reported on Cross-Connections and Similar Menaces. His paper was an excellent and thorough one, and pointed out the many ordinary means by which contamination can occur when water pressure falls. President Hinman and W. C. Groeniger discussed this paper. The latter stated that with modern plumbing having under-rim inlets, there was apt to be more trouble from this cause in the future. He recommended stricter control in connection with building permits. S. B. Morris of the Pasadena Water Department also discussed the paper, and F. Gardner Legg, sanitary engineer of the Detroit Department of Health and H. H. Gerstein of the Chicago Department of Public Works sent written discussions, though they were not present.

Boiler feed waters were being discussed in another session at the same time, under the leadership of Sheppard T. Powell of Baltimore.

The water purification dinner held Tuesday evening at the Statler Hotel under the direction of William J. Orchard of the Wallace & Tiernan Co., was a tremendous success, with an attendance of over 200.

Pipe Lines were the subject of study and discussion at the main session meeting Wednesday morning, covering steel cylinder pipe in Europe, which was discussed by Major Peter C. Bullard, U. S. District Engineer at Duluth and F. F. Longley of the Lock Joint Pipe Co. Steel trunk lines with bell and spigot joints and cast iron lines were also discussed at length. The concluding paper of this session was a sort of symposium on "Disaster Preparedness Plans for Water Works" presented by George W. Pracy superintendent of the San Francisco distribution system and discussed by John O'Neill and E. L. Filby, sanitary engineers of Louisiana and Florida, respectively, and S. B. Morris.

The water purification division held a long session, in which the first two papers were given over to superchlorination. F. E. Hale opened the session and his report on taste control of a well water by super- and dechlorination was discussed by A. M. E. Johnstone of Wallace & Tiernan and George Spalding of the Hackensack Water Co. N. J. Howard told of the progress of superchlorination for taste prevention at Toronto and of studies in chlorine absorption.

The other three papers described the use of activated carbon. The first, Chemical and Mechanical Utilization of Activated Carbon in Water Purification was by A. S. Behrman and H. P. Crane of the International Filter Co. George D. Norcom of the Federal Water Service Corporation read a paper on the use of activated carbon for the removal of taste and odor. John R. Baylis of Chicago followed with an account of his work at Chicago.

Everyone, practically, took advantage of the Wednesday afternoon inspection trip to the Howard Bend filters. There were no papers.

Deep well hydraulics, air lift vs. centrifugal and other deep well pumps, and finance and accounting practice were the subjects covered by the main meeting Thursday morning, while the water purification division considered a number of topics, including a summary of some of the neglected dangers to water quality by Jack Hinman; a description of an unusual color removal plant for a part of the Los Angeles supply, prepared by Carl Wilson, director of the laboratory of the Los Angeles water department and read, in his absence, by F. E. Hale; an excellent paper on prechlorination, with lantern slides, by

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Milwaukee's finest popular-priced apartment hotel—near Lake—four blocks from business section. Each apartment has bath and shower. Beauty salon. Dining Room. Excellent garage and parking facilities.

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MILWAUKEE

THE BELL TELEPHONE SYSTEM IS ORGANIZED TO GIVE CONSTANTLY IMPROVED SERVICE . . . QUICK, ACCURATE, EASY TO USE

What you want of the telephone . . . it is our business to give

An Advertisement of the American Telephone and Telegraph Company

WHEN you order a telephone, you want it put in promptly. During the last five years the average length of time needed to have a telephone installed has been cut nearly in half.

You want quick and accurate service, free from trouble. Good as the service was five years ago, today there are a third less troubles per telephone. During this same period there have been marked increases in the already high percentage of perfectly transmitted conversations.

When you make a toll call, you want a prompt, clear connection. Five years ago 70 per cent of all toll and long distance calls were handled while the calling person remained at the telephone. Today all but a very small per cent are handled this way.

The Bell System is organized to give constantly improved service.

Several thousand persons in the Bell Laboratories are engaged in research that improves the material means of telephony. The Western Electric Company, with plants at Chicago, Kearny, N. J., and Baltimore, specializes in the manufacture of precision telephone equipment of the highest quality. From its warehouses all over the country, it supplies the millions of delicate parts for Bell System apparatus.

The operation of the System is carried on by 24 Associated Companies, each attuned to the area it serves. The staff of the American Telephone and Telegraph Company is continually developing better methods for the use of these operating companies. Your telephone service today is better than ever before. The organized effort of the Bell System is directed toward making it even better tomorrow.

H. W. Streeter of the Public Health Service; another good one by Charles H. Spaulding superintendent of the Springfield, Ill., filter plant, on hydrogen ion manipulation; and observations on filter sand shrinkage by W. M. Wallace, Roberts Hulbert and Douglas Feben, all of the Detroit water department.

In the afternoon the main session considered the question of pumps, pumping and diesel engine use, while the water purification division continued their highly technical discussion, giving most of the time to the question of preammoniation, which aroused quite a good deal of interest.

A most interesting session was that held Friday morning at which was discussed the matter of training operating personnel for small purification works. Prof. J. S. Whitener of North Carolina State College outlined the methods employed in that state, which consists essentially of cooperation by engineers of the health department and the sanitary engineering courses of the state universities. Abel Wolman, E. S Tisdale and T. R. Lathrope discussed the problem and told of conditions in their own states of Maryland, West Virginia and Ohio.

Distribution systems were discussed also at this session. The finance and accounting division also held a session. An interesting paper in the afternoon was Water Supply for Airports, by S. F. Newkirk, superintendent and engineer of the Elizabethtown Water Co. Elizabeth, N. J., which was discussed by Clarence Goldsmith of the Board of Fire Underwriters. N. T. Veatch, Jr., gave an illustrated paper on the water supply of cities in arid and semi-arid climates. A report on service pipes of various materials was discussed by James E. Gibson and S. H. Taylor of New Bedford, Mass.

George H. Fenkell was elected president, succeeding Jack J. Hinman, Jr., and W. W. Brush was elected treasurer. Under the present arrangement, directors are elected by the various sections. The following have been elected: J. Walter Ackerman, Watertown, N. Y.; C. D. Brown, Walkerville Ont.; Eugene Carroll, Butte, Mont.; C. R. Knowles, Chicago, Ill.; J. E. Gibson, Charleston, S. C.; W. A. Kunigk, Tacoma, Wash.; S. B. Morris, Pasadena, Calif.; R. B. Morse, Hyattsville, Md.; H. S. Morse, Indianapolis, Ind.; A. P. Michaels, Orlando, Fla.; D. F. O'Brien, East Orange, N. J.; D. P. Porter, Pueblo, Colo.; A. F. Porzelius, Chattanooga, Tenn.; T. J. Skinker, St. Louis, Mo.; L. A. Smith, Madison, Wisc.; W. E. Vest, Charlotte, N. C.; H. Wright, Cleveland, O.

Officers were elected by the three technical divisions of the association as follows:

Water Purification—Chairman, John R. Baylis, Chicago; vice-chairman, Paul Hansen, Chicago; secretary-treasurer, Harry E. Jordan, Indianapolis Water Company.

Finance and Accounting—Chairman Hal F. Smith, Detroit; vice-chairman, A. R. Michael, Orlando, Fla.; secretary-treasurer, H. Gordon Calder, 27 William St., New York City.

Plant Management and Operation—Chairman, Stephen H. Taylor, New Bedford, Mass.; vice-chairman, Ray Crozier, Peoria, Ill.; secretary-treasurer A. V. Ruggles, 29 West 39th St., New York City.

American Road Builders' Association

St. Louis has been chosen as the site of the 1931 convention and road show of the American Road Builders' Association. This carries out the new policy of giving the annual gathering to a new section of the country each year. The Missouri city was chosen over the rival bids of Houston, New Orleans, and other cities of that region, because of what are thought to be superior facilities for accommodating the delegates and the exposition of road machinery and equipment. The show will be held in the Arena and the two adjoining exhibition buildings. A structure will be erected to house the convention.

Asphalt Paving Conference

At a meeting of the Board of Directors of The Asphalt Institute, held in New York, Memphis, Tenn., was selected as the meeting place for the Ninth Annual Asphalt Paving Conference to be held this year, the meeting to convene on Monday, December 1, continue through December 2, 3 and 4 and close on December 5.

The Association of Asphalt Paving Technologists will, as usual, meet in conjunction with the conference.

The arrangement will be in charge of various national and local committees created for the purpose. O. I. Kruger, city commissioner of Memphis, and W. B. Fowler, Memphis city engineer, are assisting in organizing the committees which will have charge of the local arrangements. An elaborate entertainment program is being planned.

From one thousand to fifteen hundred engineers, technologists, public officials, contractors and asphalt producers, are expected to be in attendance, since an effort this year will be made to break all previous attendance records.

International Association of Street Sanitation Officials

The next meeting of this association will be held at Louisville, Ky., October 9-11. The headquarters of the association, and the conference will be at the Brown Hotel. An unusual list of speakers and subjects is scheduled for the meeting. A. M. Anderson, 100 No. LaSalle St., Chicago, Ill., is secretary.

Water Works Manufacturers' Association

At the meeting of the association held at St. Louis, June 5, officers were elected as follows: president, H. Seaver Jones of the East Jersey Pipe Co.; vice-president, Willard Chevalier of the *Engineering News-Record*; secretary, J. A. Kienle of the Mathieson Alkali Works; treasurer, E. J. Buttenheim of the *American City*. The Hydraulic Development Co. replaced the Central Foundry Co. on the executive committee of the association.

New York State Sewage Works Association

The fall meeting of the New York State Sewage Works Association will be held in Syracuse, N. Y., Sept. 13, instead of Sept. 6, as previously announced.

Industrial Notes

Link-Belt Company, 300 West Pershing Road, Chicago, Illinois, announce the appointment of the following agents who will handle their complete line of Crawler Cranes-Shovels-Draglines, and Locomotive Cranes, described in their Book No. 1095: P. L. Tippett, Rhodes Building, Atlanta, Georgia; Jos. C. Fiorello Co., Larkin Terminal Bldg., Buffalo, New York; Bacon-Hibbard-Eichman, Inc., 917 Central Avenue, Cleveland, Ohio.

The Paradon Mfg. Co., Arlington, N. J., announces the appointment of Gerald Standish as representative to handle the sales and service of Paradon chlorinators in the states of Minnesota, North Dakota, South Dakota and Northern Wisconsin. Mr. Standish was formerly in the Sales Department at the main office of the Company and, prior to that time, was engaged in service engineering work from the main office. Mr. Standish will be located in Minneapolis.

Trackson Co., 500 Clinton St., Milwaukee, Wis., announces the appointment of the Millsap Road Machinery Co., 23d St. & 23d Ave., Birmingham, Ala., and the Hunter Machinery Co., 16th St. Viaduct, Milwaukee, Wisconsin, as new distributors of Trackson Tractor Equipment.

The Independent Pneumatic Tool Co., Chicago, manufacturers of Thor Electric and Pneumatic Tools and Air Compressors, has purchased the Cochise Rock Drill Mfg. Co. of Los Angeles. This purchase is part of an expansion program inaugurated a year ago.

The Hazard Advertising Corporation announce the opening of a new branch in Boston, Mass., at 950 Park Square Building, in charge of Theron S. Curtis.

The Universal Power Shovel Company Division of the Unit Corporation of America, Milwaukee, Wisconsin, announces the appointment of R. B. Crenshaw as District Sales Representative in the Chicago district.

John H. Coghlan is now the direct representative of the American Manganese Steel Co. in the New England states. His office will be located at 92 Broadway (Kendall Square), Cambridge, Mass.

The Brown Instrument Company, Philadelphia, Pa., announces the consolidation of its Chicago Sales Office and Midwestern Factory Branch in new quarters located at 155 East Superior Street, Chicago, Illinois.

C. D. McCormick, formerly Assistant Advertising Manager of The C. F. Pease Company, 813 North Franklin Street, Chicago, Illinois, manufacturers of Blue-Printing Machinery, Blue-Print Paper, Drafting Room Furniture, etc., has been appointed advertising manager to succeed W. Earle Pashley now Second Vice-President and Assistant Sales Manager. Mr. McCormick has been with the company for over four years.

The Paradon Mfg. Co., Arlington, N. J., announces the removal of their Albany, N. Y., office from 467 Broadway to new and improved quarters at 1 Columbia Place. Paul M. Nickerson remains in charge of this office and will continue to handle the sales and service of Paradon Chlorinators in Northern New York and Massachusetts.

Technical Publications

Portable Air Compressors.—Ingersoll-Rand Co., 11 Broadway, N. Y., has just published a condensed catalog of portable air compressors, rock drills and pneumatic equipment.

Metered Combustion Control.—Leeds and Northrup Co., Philadelphia, have just brought out the 1930 rewritten edition of Bulletin 660, "Metered Combustion Control for Boiler Furnaces."

Pneumatic Water Systems.—The Chicago Pump Co., Chicago, Ill., offers in Bulletin 111 a most complete collection of data on this subject. Some of the items covered in this new bulletin are: The complete history and advantages of the pneumatic water system; several assembly and layout suggestions in both single and duplex units; suggestions as to different kinds of pumps that may be used on various jobs; explanation of special equipment used with "Chicago" pneumatic installations which make them unusually quiet in operation; engineering tables and specifications for architect or engineers.

Crawler Wheels.—An eight-page circular issued by the Trackson Company, Milwaukee, Wis., describes the outstanding features of the new Trackson Crawler Wheels. These wheels are built to meet the hauling requirements of every industry and the circular will be of interest to contractors, loggers, oil field men, cane growers, pit and quarry operators, etc.

Metal Painting.—This booklet embraces the entire field from the theories of corrosion to the latest improved practices of preventing such corrosion. It should prove useful as a reference book and as an authoritative text on metal painting.

Idlers for Belt Conveyors. — The Stearns Conveyor Company, Cleveland, a division of Chain Belt Company, Milwaukee, has recently completed a catalog and engineering data book containing complete and specialized information on the designs and application of Rex-Stearns Timken Idlers for all types of belt conveyors, together with all allied and auxiliary equipment necessary for complete belt conveyor installations.

Pavements for Modern Traffic—Street problems which concern city officials, business men and property owners are discussed in a 28-page illustrated booklet issued by the Portland Cement Association. Such important topics as the value of good pavements to a community, and concrete paving practice on steep grades, between car tracks, on heavy traffic streets and elsewhere, are discussed in a helpful way. Copies will be sent free on request to the Portland Cement Association, 33 West Grand Avenue, Chicago.

Engineering and Construction Equipment

New Machinery, Apparatus, Materials and Methods and Recent Installations.

Clow Cast Iron Manhole Step

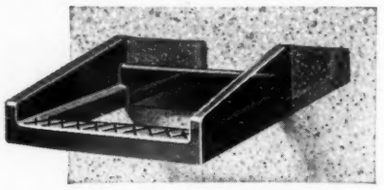
James B. Clow & Sons, 201-299 No. Talman Ave., Chicago, Ill., manufacture the A-1670 cast iron manhole step which was designed by a leading engineering firm of the city of Chicago and is one which they recommend for use in connection with all work where a fixed means of descent and ascent is needed.

These steps are made to embed into the vertical walls of sewage disposal plants, valve and conduit manholes, scale and elevator pits, for exposed wall and chimney ladders and, in fact, for all purposes where dampness and the action of the elements is to be considered.

Cast iron steps do not corrode or rust out. Made from the same metal fixture as is used in the making of cast iron pipe, such steps will last indefinitely. Considering long life, no replacement cost and factor of safety, their use is an economy.

This cast iron manhole step is suitable for embedding into either concrete or brick walls. The wide, flat, checkered tread provides a safe footing while the raised sides prevent the foot from slipping off sidewise in either direction.

This firm also manufactures a line of standardized castings for manholes and sewers.



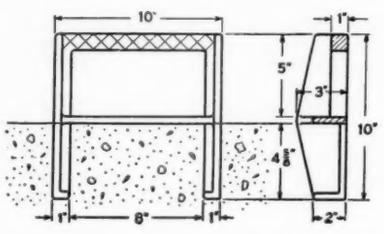
Clow Cast Iron Manhole Step

To Handle Moderate Loads Efficiently and Speedily

Frederic H. Poor, Inc.'s, Loadmaster swing crane is designed to fill the need for a unit able to handle moderate loads, able efficiently to "fill the bill" where machinery of heavy calibre would be unnecessary and uneconomical. Being compact, it is able to travel where insufficient space would prohibit the passage of larger apparatus; being mobile it is able to maneuver easily on congested operating sites, within confined areas and on crowded thorofares.

A swinging boom allows the crane to handle loads over the side. Specially designed stabilizers, attached to the front axle, create a four-point suspension at such a time and do away with the need of stiff-legs or other cumbersome devices. These stabilizers are operated by a single lever, within easy reach of the operator, and are released to give a three-point suspension when handling loads over the front or when the tractor is moving.

Besides the hoisting, swinging and transporting of loads this crane is useful as a hauling unit, it being capable of hauling trailers or side-dump cars while itself carrying a load in suspension, a feature which has proved particularly accommodating when it has allowed dirt removed from a point of excavation in a trench being carried away immediately and dumped as backfilling. During recent sewerage operations in the heart of New York city the use of two Loadmasters enabled a pace of thirty feet of finished trench per day to be maintained.



Manhole Step Dimensions

In the handling of pipe, particularly where pipe happens to be in manholes not easily accessible, the crane has proved a unit of real value.

Building construction firms, railroads, municipalities, public utilities are finding it a time saving, labor saving device.

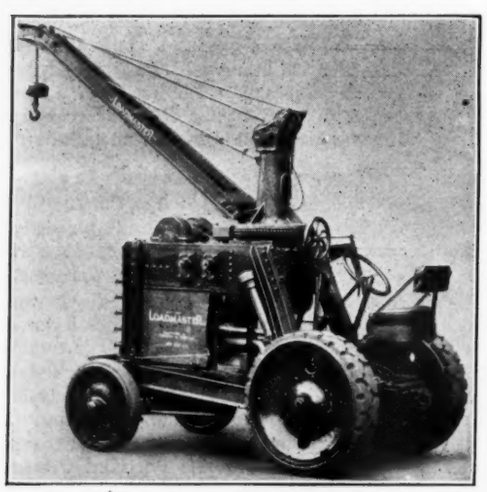
Further information can be obtained from PUBLIC WORKS or from Frederic H. Poor, Inc., 342 Madison Ave., N. Y.

"Caterpillar" Announces One-Man, 7-Bladed Planer

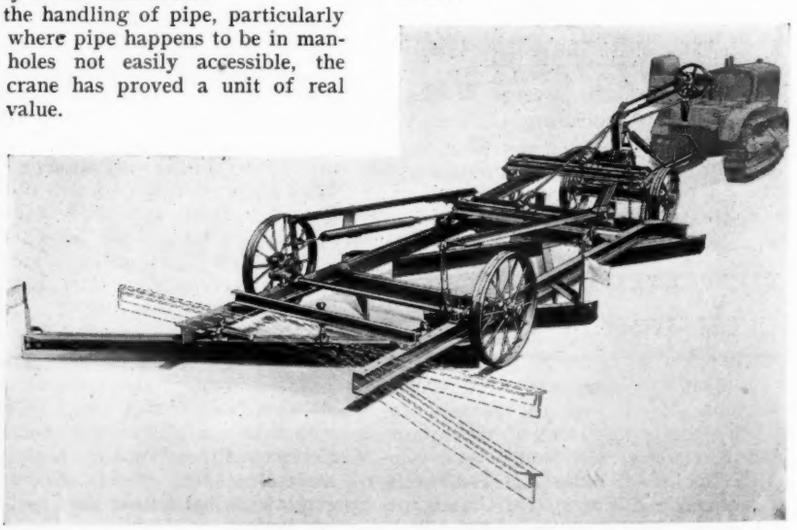
A planer that can make an 11-foot cut and leave a road as smooth as a floor, a planer that is easily operated by the tractor driver with a single hand wheel, a planer that has seven blades to shave the bumps and washboards and spread the surface material back and forth is the newest member of "Caterpillar's" road-building family.

The planer is built to work with the "Caterpillar" Twenty, but a few minutes' work uncouples the two, leaving the tractor free for other work. The tractor operator controls the planer from his side-mounted seat with one hand. The regular tractor controls are at his left hand, and the foot pedals are extended to a position beneath his feet. He has full view of the road ahead and the work behind.

The local "Caterpillar" dealer or the factory at San Leandro, Calif., or Peoria, Ill., will supply further information.



The Loadmaster Crane



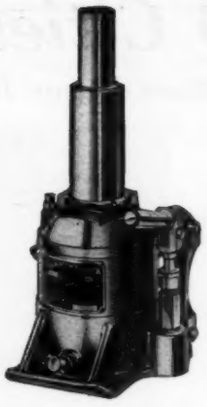
Caterpillar 7-Blade Maintainer

Wood Slant Type Hoist

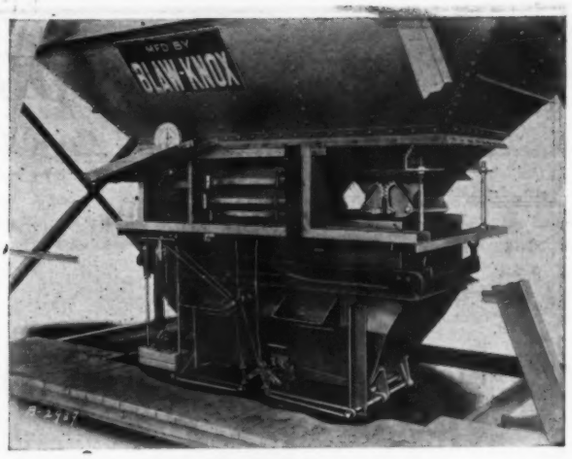
The Wood Hydraulic Hoist & Body Company, Detroit, Michigan, has announced a new Wood improved slant type hydraulic hoist. Features of this new hoist are new power to lift the heaviest loads, new speed for fast dumping, new, rugged unit construction.

The new slant type hoist is produced in seven models to meet every dump truck requirement. Each unit is a solid all-steel unit, of simplified construction and great strength, to exceed any load it will be called upon to bear. In addition to this, an important feature of this new Wood hoist is its advantage of lifting ahead of the load center.

The hoist is controlled by two levers inside the driver's cab. It can be raised lowered or held in any position and stops automatically at fully raised or lowered positions.



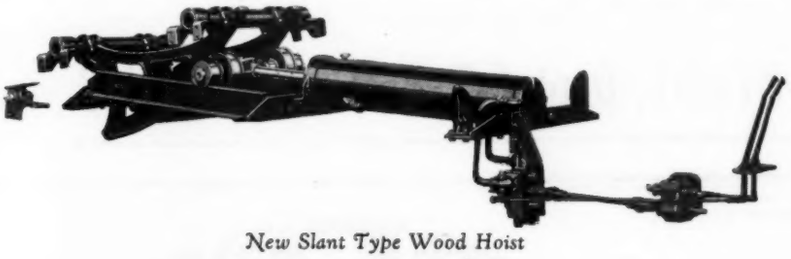
Blackhawk D8.7



Blaw-Knox Triple Weighing Batcher

Blackhawk Jack Models for Trucks and Busses

Two new hydraulic jack models have been announced by the Blackhawk Mfg. Company of Milwaukee, Wisconsin.



New Slant Type Wood Hoist

With either one of these jacks it is unnecessary to dump a full capacity load, inconvenience passengers or waste costly time in laborious jacking methods.

Their exceptional lowness and extreme lift make them particularly adapted to low front axles—a necessity where large diameter tires are used.

The D8.7 is a 12-ton model, 8¾" low, with a single 5" lift and 3" hand screw extension or a total height of 16¾"; weight packed only 31½ lbs; equipped with one-piece handle.

Model M7.3 is a 5-ton jack only 7 5/16" high when collapsed; telescopic lift of 7 3/16" gives a total height of 14½"; improved sled base for ease in placing and removing jack; serrated saddle is integral with upper plunger; lantern type handle provides comfortable carrying grip; weight packed only 25½ lbs.; complete with 34" two-piece handle.

R. C. Units for Retaining Walls

The R. C. Products Co., Cleveland, O., and Graybar Bldg., New York, manufacture RC automatic, interchangeable, flexible units for retaining wall construction. It is stated that the cost of retaining wall construction can be cut 50 per cent.

There is a saving from the standpoint of labor costs, for skilled men are not needed. A retaining wall can be thrown up quickly and just as quickly torn down, and salvaged.

The stretcher or stringer and header or anchor member are the only two units needed. With these two units a wall, in either bin or staggered formation can be built safely to a height of more than 50 feet.

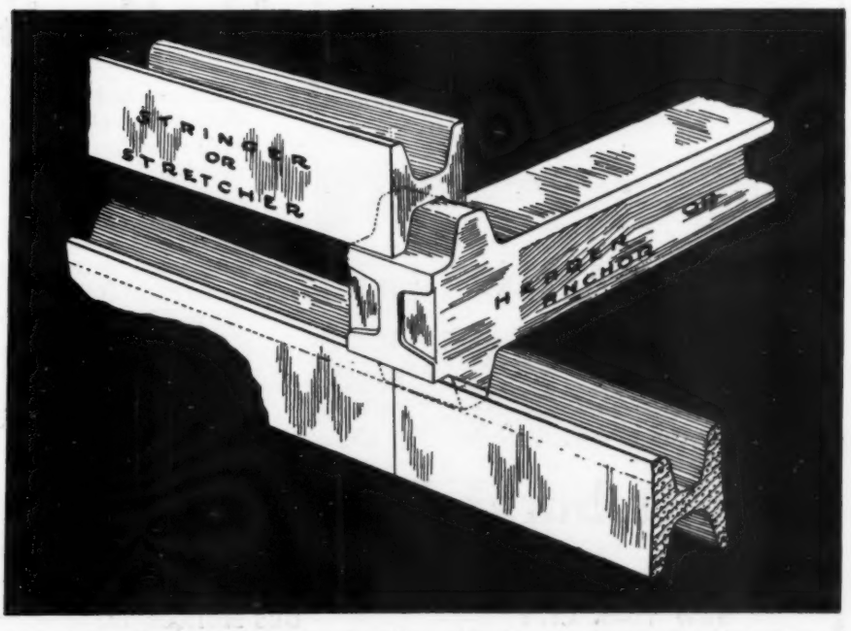
To construct, it is necessary simply to place the two units—header and stretcher—in position and they automatically interlock and square away. When once placed in position, they present an enduring and permanent type of retaining wall of excellent appearance that will serve its purpose as long as demanded.

Curvature of the wall does not present any unusual problem, for any desired radius of curvature can be readily and accurately made and maintained by careful positioning or aligning of header lengths.

No special equipment is necessary. The headers come in standard lengths of 3, 4, 6, 8 and 12 feet; the stringers are 6 and 12 feet long.

Triple Weighing Batcher

Blaw-Knox Company presents its latest improved type of Triple Weighing Batcher for three-compartment bins. A notable feature is he new clamshell gate for each compartment, with easy lever arrangement for quick operation and accurate control.



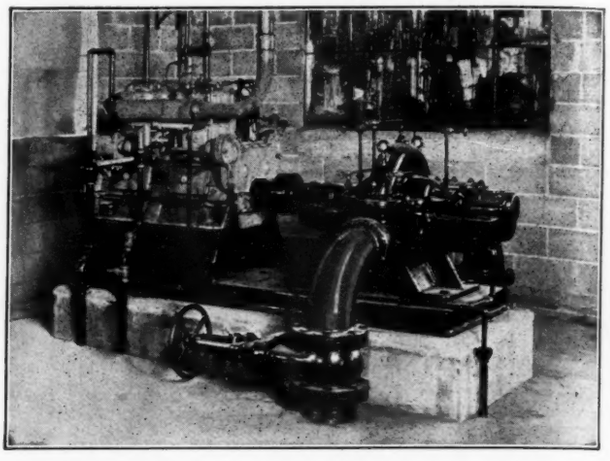
The design illustrated shows the flexibility of R. C. construction, the elimination of dowels and grouting, pillow and filler blocks and troublesome fittings

1000 Cities

in United States and Canada Have Power Instantly in Emergency

Sterling High Duty

Internal Combustion Engines

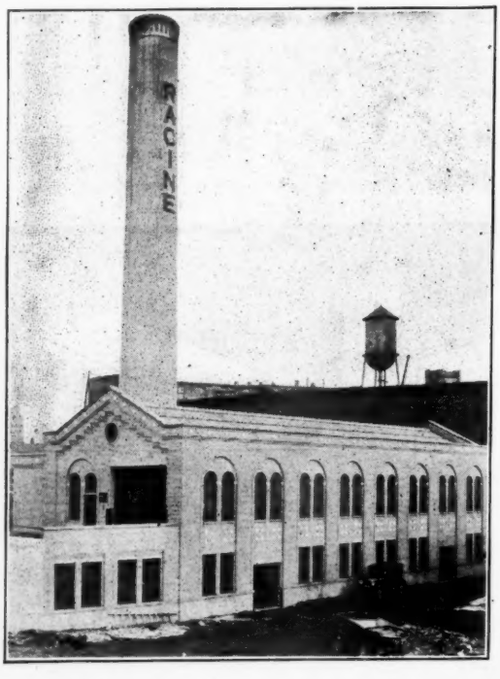


Belle River, Ont., 6″ DeLaval pump 500 Imp. G. P. M., 250′ head requiring 63 H. P. 1450 R. P. M., driven by a 4 cylinder 100 H. P. model FC-Sterling engine for emergency.

And There Are Definite Reasons Why They Chose Sterlings

12 to 565 B. H. P.—Gas or Gasoline

STERLING ENGINE COMPANY, Dept. C-5, Buffalo, N.Y., U. S. A.



PDM STEEL PRODUCTS

On the Big Racine Job

the municipal officials could not afford to experiment with their incinerator project. The site for the new Racine City Hall is within a stone's throw of the incinerator site. Both new buildings must be modern in design and carry out their plan of civic improvement.

At the left is shown the big Pittsburgh-Des Moines installation finally decided upon. This scientific disposal plant has three PDM furnace units already installed with a daily capacity of 120 tons and an ultimate daily capacity of 200 tons when the two remaining furnaces are installed. It is clean, odorless and a distinct asset for this progressive Wisconsin City.

Municipal officials write today for the new PDM Incinerator Catalog No. 77.

Pittsburgh-Des Moines Steel Company

79 Neville Island, Pittsburgh, Pa.

683 Hudson Terminal Building
NEW YORK CITY

981 Tuttle Street
DES MOINES, IA.

1289 First National Bank Building
CHICAGO, ILL.

Complete Handling and Batching Plant for Bulk Cement

The Blaw-Knox Company extends the scope of its engineering service to contractors interested in the handling and batching of bulk cement for road paving and for central mixing, enabling the contractor to secure the price benefit of buying his cement in bulk.

The complete plant arrangement is made up of the following units, illustrated in the accompanying picture—Power Shovel (A) driven by 15 H. P. gasoline engine (B) removes cement from railroad cars and deposits it into a folding boot extension (C) which empties into bottom of vertical elevator (D) which discharges into a 21-ton self-cleaning steel cement bin (E). The Weighing Batcher (F), an integral part of the steel bin, receives cement through a series of manually operated gates, whence it is deposited into a 10 inch diameter canvas tube. This tube terminates in a countered sheet metal bell, which spreads the cement on top of a truck-load of previously loaded aggregates.

This plant is variable as to capacity, and conveyer discharge for special cement cars can also be furnished.

International W-3 Heavy Duty Truck

A Pump That Makes and Keeps Its Own Prime

Much interesting development and research work has centered around a new self-priming centrifugal pump that the Chain Belt Company has recently put on the market. C. I. Longenecker developed this new pump. The pump is in addition to the line of pumps the company now manufactures and is a part of their line of construction equipment consisting of concrete mixers, pavers, saw rigs, central mixing plants, etc. No matter whether the depth of the hole is twenty-seven inches or twenty-seven feet and regardless of what the amount of water may be, the pump will keep its prime with greater lifting capacity. On many pumping jobs there are times when very little water is in the hole, in fact barely a cupful.

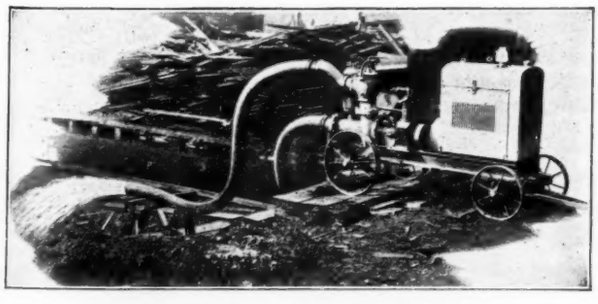
The new self-priming centrifugal requires no attention even though the water does go below the end of the hose. The vacuum is maintained automatically and the pump needs no priming. Just as soon as the water begins to drop the vacuum pump begins to exhaust the air and pick up the prime again. Ordinarily there are air pockets at the hub of the centrifugal vanes. These pockets interfere and many times destroy the prime. In the new self-priming centrifugal, Mr. Longenecker has made it possible to remove these air pockets before they can be sealed and not to interfere with the pump's prime, also its lifting capacity.

Ingersoll-Rand Bench-Type Pedestal Grinder

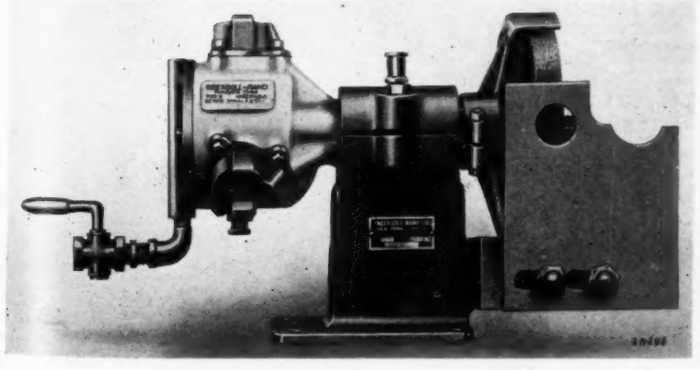
Ingersoll-Rand Co., 11 Broadway, New York City, announces a bench-type pedestal grinder, known as the Type 9, which can be bolted to a bench or a portable air compressor. The flow of air to the motor is controlled by a hand-operated globe valve. The machine has a free speed of 3000 r.p.m. and is designed to take a vitrified grinding wheel 6″-8″ diameter with a ½″ face. At the end of the grinder spindle, a bit chuck is screwed to take a drill or reamer with ½″ straight shank.

International Heavy Duty Trucks

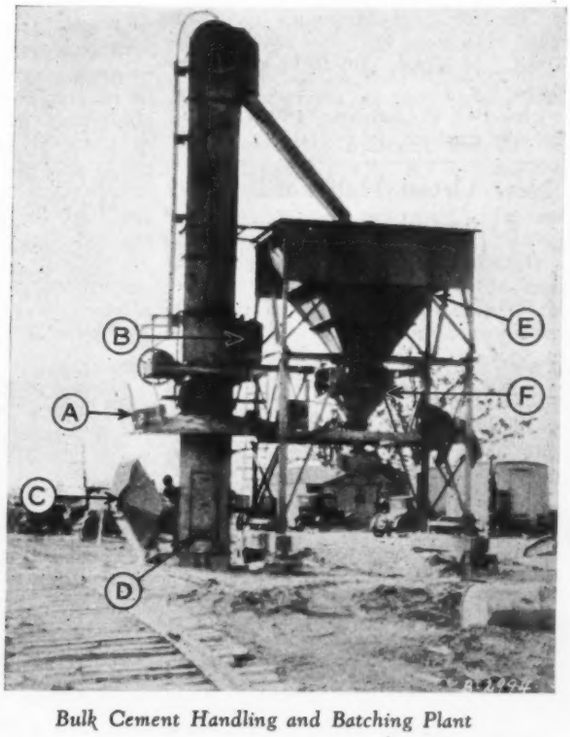
The Model W-1 and Model W-3 are recent additions to the International Harvester line of heavy-duty motor trucks. The rated capacities of these new units are respectively 2½ tons and 3½ tons. Both trucks are of the double reduction drive type and each is available in five wheelbases, the W-1 from 130 inches to 200 inches and the W-3 from 144 inches to 235 inches.



Chain-Belt Self-Priming Pump



Ingersoll-Rand Bench Pedestal Grinder



Bulk Cement Handling and Batching Plant

New Link-Belt High Capacity Crawler Loader

Detail of Loading Device

Link-Belt Announces New Crawler Loader

Link-Belt Company, Philadelphia, announces the development of a new high-capacity crawler bucket loader, which is to be known as "The Grizzly, 1930 Model"; and that, after having given the machine a thorough try-out under actual working conditions, they are going into production on a large scale.

The machine has a rated capacity of 1¾ cubic yards per minute, based on handling sand, stone and gravel, 1½" and smaller; run-of-mine coal, coke, etc. Larger stone may be handled at a somewhat smaller capacity.

The power unit regularly includes a 30 H.P. Buda gasoline engine, or a 20-horse electric motor, for operating the bucket, elevator, the feeder, and the crawler traveling mechanism.

The crawler frames are one-piece steel castings. The crawler is wide and long to give the machine ample stability for the gruelling work to which such machines are customarily subjected. It is also said to be self-cleaning.

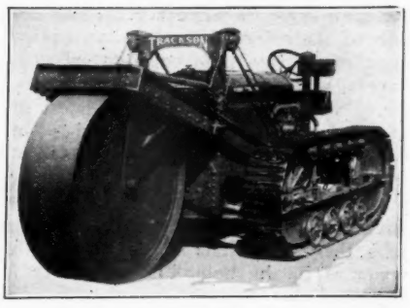
Link-Belt Folder No. 1149, covering the new machine, is available.

New Orton Half-Yard Convertible Excavator

Outstanding improvements in the design of small excavators are incorporated in the new Model 4 machine recently developed by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill. This is equipped with a 40-hp. four-cylinder gasoline engine, which has an accelerator arranged for both hand and foot operation, electric starter, oil filter, air cleaner and other modern accessories.

The traveling speed can be varied from ⅝ to 3 miles per hour. This wide range gives high traveling speed for smooth road, together with great tractive effort for traveling on rough ground, it being possible to negotiate a 25% grade. A special main cutout clutch enables the operator to stop all of the machinery except the propelling mechanism when traveling, a decided advantage when going any considerable distance.

Sluing can be done at a speed of four revolutions per minute, the clutches being of the double-cone type with the "Orcoin" blocks forming a complete ring. A foot brake locks the superstructure in any position. The boom hoist is operated by a bronze worm-wheel and forged steel worm.



Trackson Trench Roller

The Model 4 excavator is readily convertible to shovel, crane, dragline, ditcher or skimmer, and changes to these attachments can be made in the field.

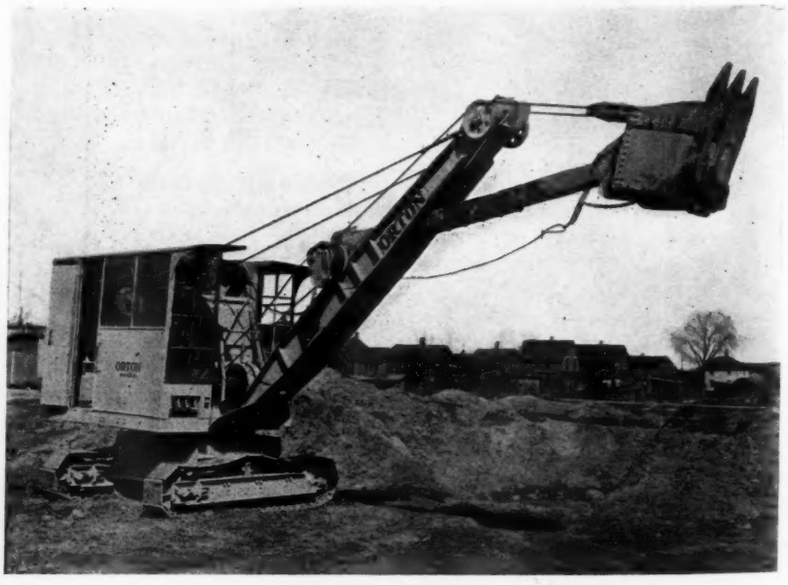
An extension of the cab for the operator's position gives a clear view of the work on both sides of the machine, and the levers are conveniently located. Each function of the Model 4 is controlled by a separate lever, and the control and speeds are arranged so that it is possible to make five trips per minute in regular operation.

Trackson Trench Roller

An interesting recent development in construction equipment is the new Trackson Trench Roller, which provides a simple, effective and economical method of packing down dirt over newly laid cable, conduit or pipe line.

This roller is built for mounting on the Model DH Trackson McCormick-Deering crawler tractor.

It consists of a wide steel roller filled with concrete, which weighs from 3000 to 4000 pounds, the weight varying to meet the requirements of different soil conditions. For average jobs a 3500 lb. roller is recommended.



Orton Half-Yard Convertible Excavator

Sno-Bar—An Improved Snow Fence

George L. Barrus Co., Lithia, Mass., manufacture Sno-Bar, an improved type of snow fence, which is made of collapsible steel posts and common rough-sawed 1x6 boards. It is designed on a slant, which deflects the wind upward and more effectively prevents drifting on the highway. The posts, when erected, are 5 feet high, which eliminates the necessity for more than one line of fence. No unit weighs over 20 pounds, which is of advantage in placing. For 100 feet of fence 8 posts and 309 board feet of rough lumber are used. Erection can be accomplished in one third the usual time required to set snow fence. Rocky or uneven ground does not interfere with setting. Sno-Bar nests and requires a small amount of space for storage.

The standards of Sno-Bar are guaranteed for a use of 20 years, and should last longer, it is stated.

New Edson Diaphragm Portable Power Pump

The Edson Manufacturing Corporation recently developed a diaphragm portable power pump. This is Edson's style "OM-T" trailer pump unit and embodies the new Edson type "M" diaphragm pump which is usable either as open discharge or in connection with discharge hose as a force pump. This pump is operated by the Edson "On Top" air cooled gasoline engine mounted on a two-wheel trailer. This Edson type "M" force pump is a most efficient power pump. It is so constructed that it is very easy to replace a diaphragm. Also the outfit being nicely balanced it is easily managed by one man.

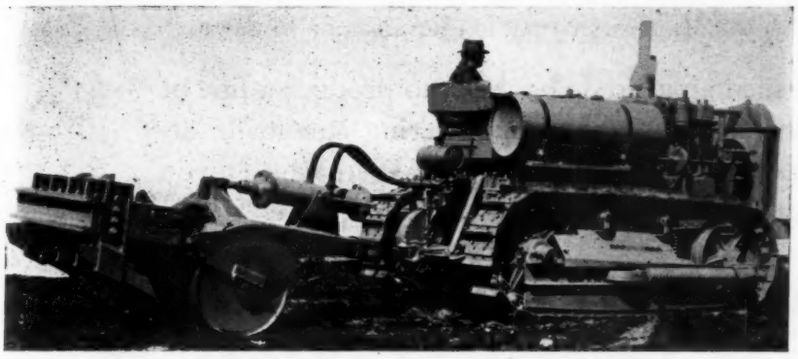
Toledo Folding Steel Horse

The Toledo Pressed Steel Co., Toledo, O., manufactures the Toledo Folding Steel Horse.

Toledo Folding Steel Horse

A pair consists of two steel A-frames made from heavy gauge 3-inch ribbed channel section. Drop any standard sized stick of timber between the jaws, spread the feet until the jaws grip the lumber, step on the toggle joint and the legs are securely locked to the rail. Rails may be butt-jointed, one A-frame at each joint, where long lines of barrier are required. To disassemble, kick up the toggle joint, the wood rail is released and the steel horse folds compactly for transportation or storage. There are no loose clamps or bolts or other parts. The wood rail may be utilized for other purposes, as it has not been mutilated.

Road commissions, street railways, and other public service corporations use this horse for barrier construction. In addition to barriers, contractors use them for constructing miscellaneous supports, temporary benches, scaffolds, etc. The horses come in eight heights, 18″ to 60″, in various models for accommodating 1″ or 2″ rails (on edge or 2x8's flat). A pair weighs about one pound per foot of height.



The Ateco Hydraulic Scarifier with Caterpillar Tractor

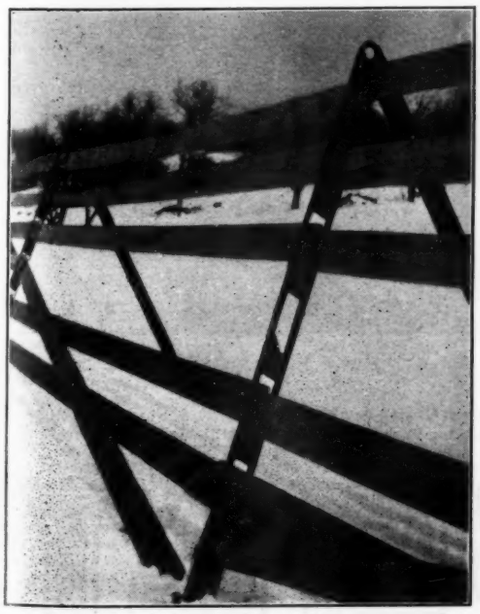
Ateco Hydraulic Scarifier

The American Tractor Equipment Co., Oakland, California, builds the "Ateco" hydraulic scarifier for use with the caterpillar "60" tractor. It is designed for the heaviest work, and by means of the "Ateco" hydraulic one-man control can be instantly regulated to dig to the required depth within the range of the scarifier, which is 24 inches with the teeth clearing the ground 6 inches when raised. The depth of cut and the height of teeth above the ground when raised can also be regulated by raising or lowering the standards in the main frame.

Attached to the drawbar of the tractor, the wheels travel on the hard ground ahead of the scarifier frame so that the depth to which the teeth are cutting can be instantly controlled.

The weight of the Ateco hydraulic scarifier is 5,600 lbs.

The Ateco hydraulic scarifier is interchangeable with the hydraulic dirt-mover and tamping roller built by the same company, and can also be used in combination with the Ateco bulldozer on the same tractor. When the tractor has been equipped with Ateco one-man hydraulic control, it is ready for operating all other Ateco tractor equipment.



The Sno-Bar Fence Is Simple and Economical; Effective and Easy to Put Up

"Built by Link-Belt"

TO engineers the phrase "Built by Link-Belt" has become synonymous with dependable performance. The Company's policy, pursued for more than 50 years, has earned for Link-Belt products a justified reputation for reliability.

Engineers and operating men have learned through practical contacts that Link-Belt equipment is built to high practical ideals, and with the purpose of giving the customer a little more than he expects. "Built by Link-Belt" also symbolizes an ambition to improve and to better Link-Belt products year by year, and to maintain a Company policy devoted to the interests of their clients.

The natural result of such an attitude has been to produce a line of dependable equipment, and to expand engineering and manufacturing facilities to meet the growing demands of users who buy on the basis of performance.

Screens, Collectors and Aerators For Sewage Treatment Plants

Our engineers will be glad to cooperate with you and supply detailed information about Link-Belt equipment.

Bar Screens, Grit Collectors, and Washers, Fine Screens, Sludge Collectors for Primary and Final Tanks, Mechanical Aerators and Mixers.

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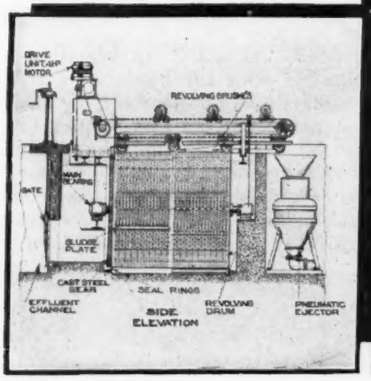

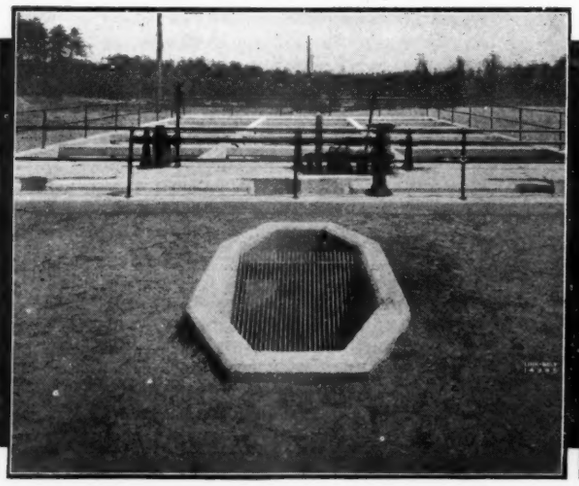

Center — Link-Belt sludge collectors. Below — Link-Belt aerator.

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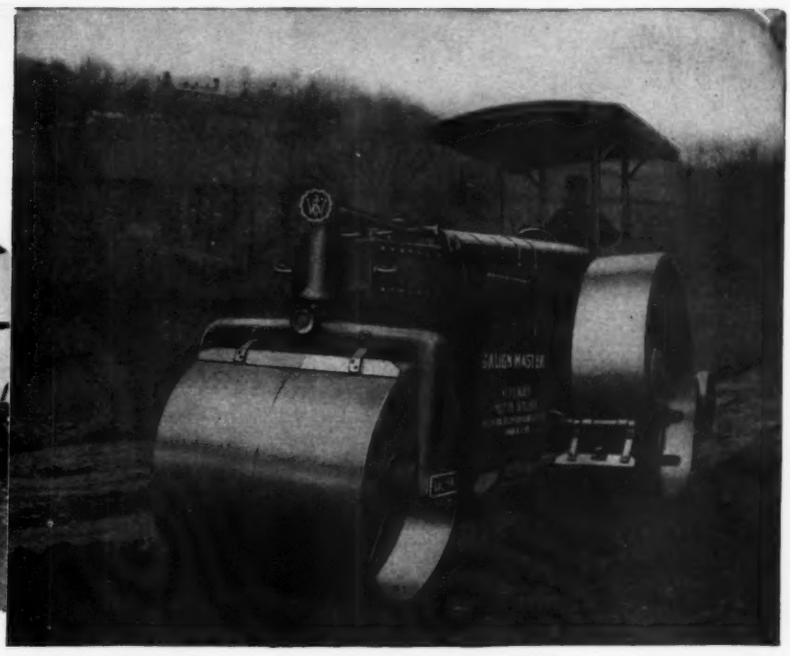

Give that Tough Job . . to a **Galion Master Roller . . .**

Practically every type of roller service is accomplished by the Galion Master Roller. In the above illustrations the Galion Master is shown in actual operation on a few of the tough jobs.

Whether it is climbing stone—bull-dozing—rolling down earth fills—close-to-curb rolling—rolling steep grades—drawing big road graders in action—scarifying—packing ditches—rolling asphalt—etc., the Galion Master is easily master of them all.

The Galion Master has ample power to go where it is needed. Abundant power is furnished from a 55 H. P. 4-cylinder, heavy duty, slow speed motor. Heavy duty Twin Disc clutch—gives extra capacity and smooth engagement under load. Machine-cut, heat treated gears of special alloy steel used throughout transmission and differential.

Other special Galion Master features are: Alemite oiling system; two separate brakes, either sufficient to give complete control; thoroughly braced, heavy steel, one-piece frame assembly.

Segment worn steering—easy, immediate action—no chains to wind; front rolls of gray iron, operate independently on high carbon nickel steel axle; 72-inch rear rolls with double refined wrought iron spokes; roller and ball bearings used in abundance—phosphor-bronze bearings in rolls.

Galion Master Rollers can be furnished in 10 or 12 ton sizes with or without powerful and efficient scarifier attachment.

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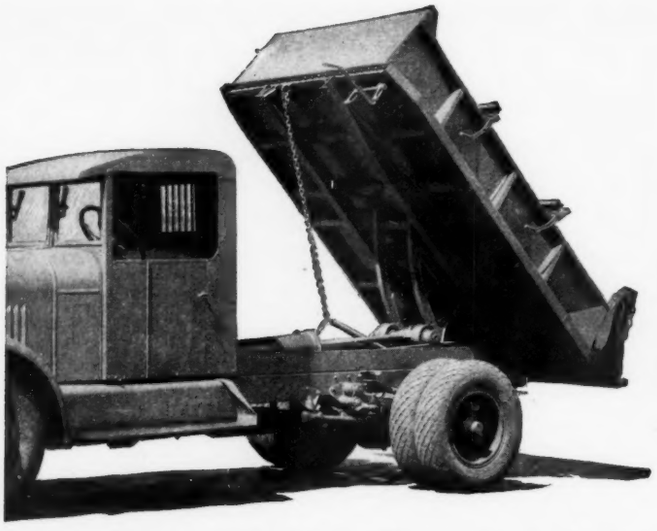

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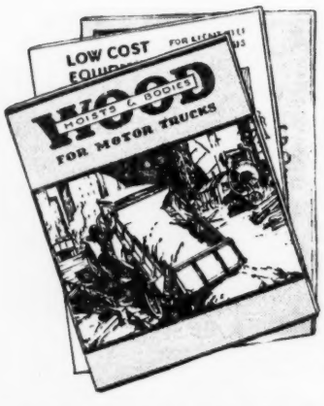

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With Our Authors

P. M. Tebbs was granted the Degree of B.S. in C.E. from Purdue University in 1907, and the Degree of C.E. in 1914, in highway engineering from the same institution. Shortly after his graduation in 1907, he was employed by the Isthmian Canal Commission on construction work in the Panama Canal Zone, where he remained for six years. During the first three and one-half years of his work in Panama he was employed on municipal and miscellaneous work, including the construction of city streets, rural highways, and sanitary work. He was later employed on the Pedro Miguel lock construction and was acting superintendent on this project for a time. He was the resident engineer on fortifications on the Pacific entrance to the Canal and started this construction. He later was employed on permanent building foundations on the Balboa Terminal construction.

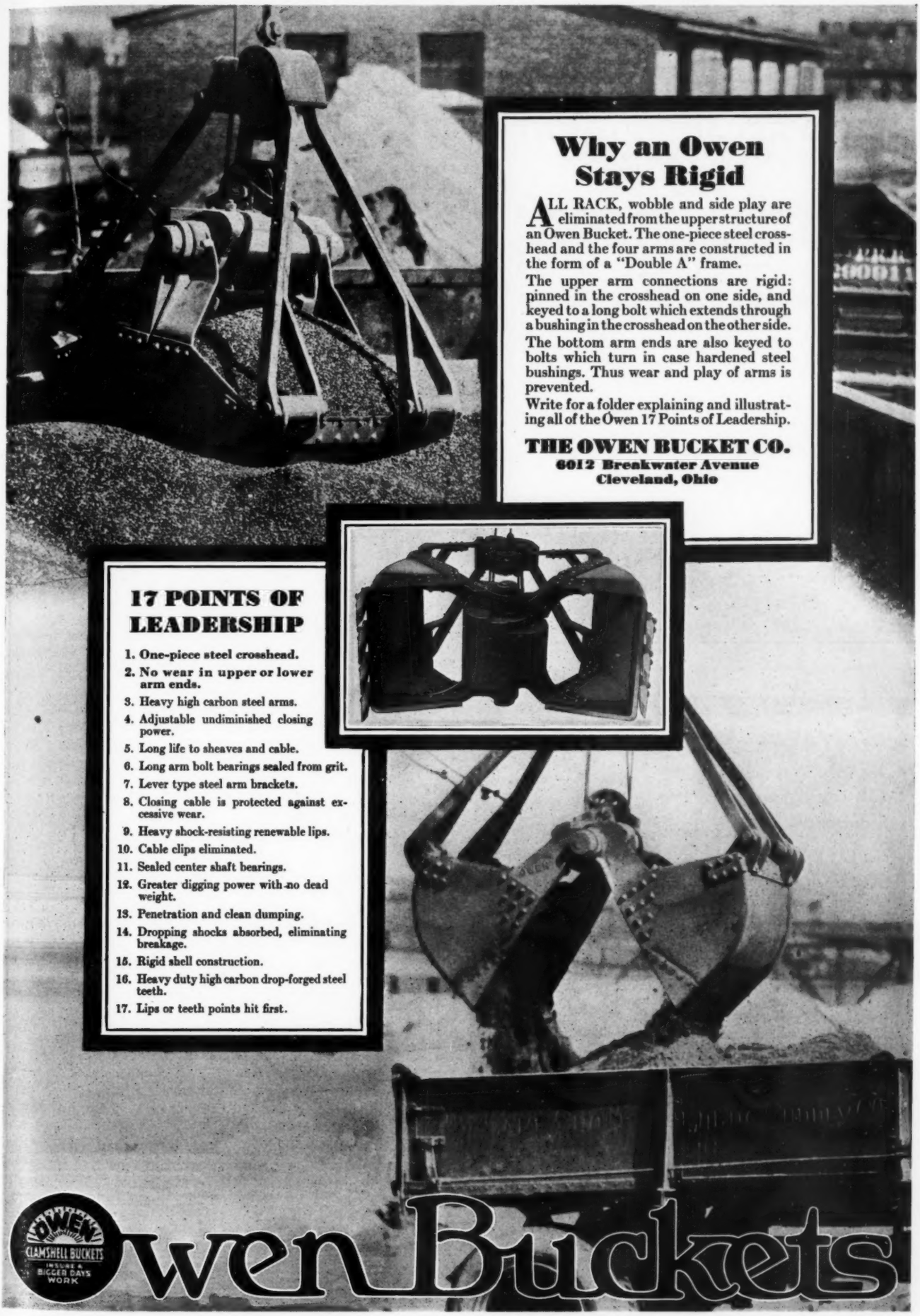
He left Panama to go with the Pennsylvania Department of Highways in 1913, where he has been employed continuously since. He was, first, office assistant to the Chief Engineer and later District Engineer in charge of six counties in the northeastern section of the State. In 1916, he was appointed Construction Engineer and since that time has been in charge of the field construction work continuously, during which time Pennsylvania's Highway System has been developed. In 1927, he was appointed Assistant Chief Engineer and shortly thereafter was also made a Deputy Secretary of Highways.

Mr. Tebbs has had numerous important committee assignments with the American Association of State Highway Officials, Concrete Institute, American Society of Civil Engineers, Highway Research Council, and the American Road Builders' Association.

The article in this issue "Efficient Operation of Concrete Paving in Pennsylvania" was written by Mr. Tebbs and his assistant, Mr. Buckius. We consider it one of the best we have ever published.

E. C. Garvin is the author of "Graphic Charts in Municipal Reports." Illustrated are a number of very well-prepared charts, which the reader will find on page 29 of this issue.

Mr. Garvin was educated at Case School of Applied Science, Wabash College and George Washington University, Washington, D. C., where he received the degree of B. S. in C. E. in 1907. His experience covers seven field seasons with the Topographic Branch of the U. S. Geological Survey, twelve years with the U. S. Engineer Department and 12 years in municipal engineering and executive work. After experience culminating as Senior Assistant Engineer of the U. S. Engineer district with headquarters at Savannah, Ga., in 1918, he became director of Public Works in St. Petersburg, Fla., city manager of Fernandina, Fla., and, in 1928, city manager of Brunswick, Ga. He is an associate member of the A.S.C.E., and a member of the A.S.M.I., and of various other engineering and governmental bodies.



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Joseph E. English, Engineer of Streets, Department of Public Works, Trenton, N. J., is the author of the article describing snow removal in Trenton. Mr. English was graduated in Civil Engineering from Rensselaer Polytechnic Institute and Lehigh University. After one year in the Maintenance of Way Department, Baltimore and Ohio R. R., he spent twenty years in the Engineering Department of the city of Trenton, eight years of which were in the capacity of City Engineer of Highways.

He is an Associate Member, American Society of Civil Engineers; Secretary, Mercer County Planning Commission; Past President, Engineering Club of Trenton, of which organization served as Secretary for ten years.

H. J. Hanmer graduated from Syracuse University in 1906 with the degree of C.E. In March 1907 he came to work for the City of Gloversville and has served that city continuously since that time—from March 1907 to September 1913 as Assistant Engineer, and from September 1913 to date as City Engineer.

He is a member of Phi Gamma Delta Fraternity, an associate member of the American Society of Civil Engineers, a member of the Mohawk Valley Lodge No. 276 F. & A. M., a member of the Eccentric Club, Sir William Johnson Country Club, Y. M. C. A. and First Methodist Episcopal Church, all of this city.

Since he has served the city, many miles of pavements, graveled streets, sewers and a sewage disposal plant have been built under his supervision. The construction and maintenance of all highways, bridges and sewers comes under the work of the City Engineer, together with the operation of the sewage disposal plant and snow removal in the winter.

This is not the first time Mr. Hanmer has contributed to PUBLIC WORKS. His contributions are always welcome and of real value. The article "Snow Handling in Gloversville" will be found on page 26 of this issue.

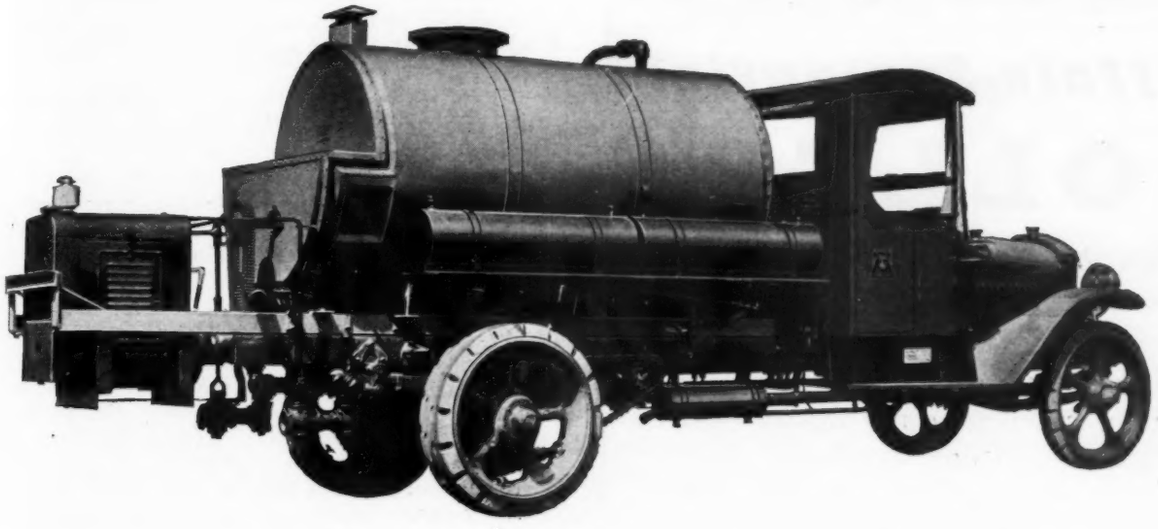
J. H. Dennis, engineer of the County road commissioners, Flint County, Mich., has been engaged in highway work for the past seventeen years, the first nine of which was spent with the Michigan State Highway Department. The last four years of this time were in the capacity of District Engineer for District No. 7, located at Port Huron. He has been employed as County Engineer for Genesee County, in Flint, for the past eight years.

The article by Mr. Dennis appears on page 22 of this issue.

G. M. Ridenour, Research Engineer of the Department of Sewage Research, N. J. Agricultural Experiment Station, is one of Prof. Willem Rudolf's assistants. In his article he outlines the New Jersey attitude regarding the use of institutional water and sewage plants for experimental work. *William J. Caward* is assistant engineer in the office of the County Engineer of Monroe County, N. Y., where snow fall and traffic are both heavy. *P. M. Johanning* is mechanical engineer of the Department of Public Works of the City of Milwaukee. His article, published on page 19 of this issue, describes the methods of snow removal employed in that city.

R. M. Rumsey is county engineer for Niagara County, N. Y. *H. H. Hatch,* author of the article describing the Cobble Mountain Dam foundations, is Division Engineer of the Springfield, Mass., Bd. of Water Commissioners.

Introducing



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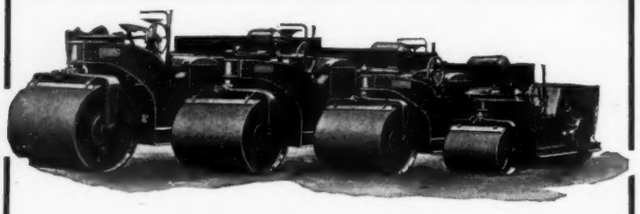

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In the case of a road roller every hour lost is a serious matter—particularly on time contracts. With Buffalo-Springfields on the job, there is a sense of security in their reliability exceedingly gratifying to the contractor, whether on maintenance or new construction.

Built in a wide range of weights and sizes, both three wheel and tandem, steam and motor driven.

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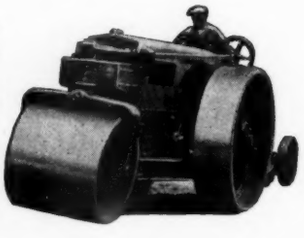

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BOOK REVIEWS

Handbook of Culvert and Drainage Practice. Published by the Armco Culvert Manufacturers Association, Middletown, Ohio. 171 illustrations, 349 pages.

It is too bad that the man or men responsible for the preparation of this handbook are not given proper credit, because it is one of the best written and most complete texts that we have had the pleasure of reviewing for some time. It deserves a prominent place in the library of every engineer who is likely to have much to do with culvert, drainage, runoff and related problems.

Perhaps the best way to review this unusually fine book is to give an idea of what is covered by its eight sections and 37 chapters.

The first section of two chapters is really an introduction, calling attention to the various kinds of drainage and their application to the more common problems of engineering. The second section reviews research, and in a concise and simple manner describes and classifies soils so that the reader is started off with the necessary understanding of the terms used in this work and with some knowledge of the characteristics and qualities of the various soils. Culvert durability investigations, culvert rating methods, data on culvert loadings and strength, a summary of the methods for calculating culvert opening sizes, and a very complete study, with numerous examples of actual late field installations, of culvert construction costs, make up the remainder of the 90 pages devoted to Section II.

In Section III, 34 pages are given over to the question of culvert design, and some very valuable data are presented on culvert sizes, culvert length, and location. Other subjects covered in this section include selection of types and materials and a discussion of strength and durability requirements.

The same general topic is continued in Section IV, but with reference to special design problems, and the subjects discussed by chapters are: The prevention of bank erosion; the factors in the choice between a small bridge and a large culvert; the use of the jacking method for providing drainage openings; the use of headwalls; and the problem of enclosing small streams.

With the increased knowledge about soils, their bearing power for roadway and other structures, and the important part they play in causing failures, has come the necessity for more knowledge on the subject of control and removal of soil moisture, that is, subsurface drainage. This matter is discussed in the 47 pages of Section V, under the following principal heads: Needs and principles; design of roadbed subdrainage; design of land subdrainage; highway applications of subdrainage; railway applications of subdrainage; municipal applications of subdrainage; and miscellaneous subdrainage problems. Each of these is taken up in detail and the text is fully illustrated with drawings showing methods and practice. This section is one of the most valuable in the book, because in it is collected so much information, which is presented in a related and balanced fashion. Hitherto, such information has been available only through a variety of sources, almost entirely uncorrelated.

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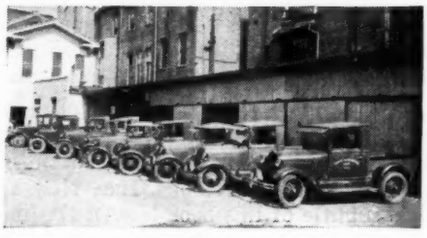

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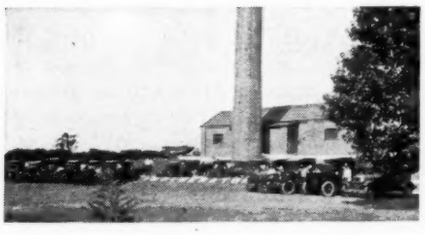

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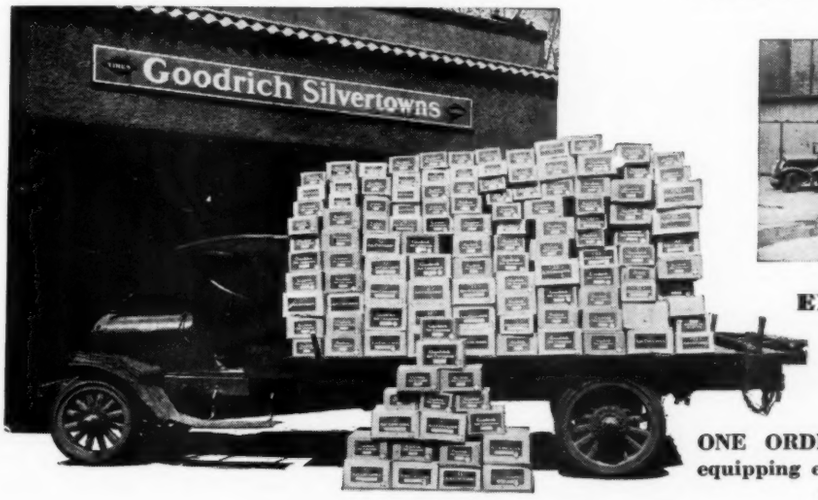

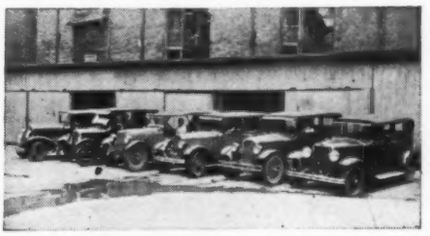

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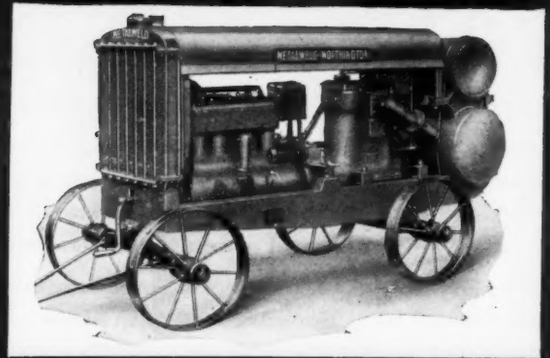

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Section VI covers street drainage, storm sewers, airport drainage, and landslides. Practice in the first two of these is pretty well presented in other texts, and is fairly standardized anyway. But the two latter subjects are presented adequately, we believe, in a book for the first time, though numerous articles have appeared in the technical journals on these subjects within the past year or two.

Section VII covers land reclamation by drainage. Section VIII is given over to field instructions. In considerable detail is given advice and information for installing corrugated metal pipes, including large diameter and perforated metal; full instructions for the use of the jacking method; data on the installation of Calco automatic drainage gates; and instructions for field sampling in connection with culvert investigations. Following is a list of drainage, general and conversion tables, which will be of value for reference.

The price of this book is $2. It is worth it many times over. It is of the proper size for carrying around in the pocket, while the cover is a neat flexible fabrikoid. The binding is none too good, however, and ought to be made stronger, because this book is going to get a lot of wear.

Water Supply and Utilization.—By Donald M. Baker and Harold Conkling. 155 illustrations, 495 pages. John Wiley & Sons, Inc., New York. $6.

The subtitle of this book is: An Outline of Hydrology from the Viewpoint of the Arid Section of the United States together with an Outline of Water Law and its Administration as it has developed in the Arid States.

The utilization of water has been the subject of much interest and discussion in the western states where water supplies are often inadequate to meet the demands of irrigation, power and domestic use. This book represents an assembling of the accumulated data resulting from research and field work over a period of years. It starts with a discussion of precipitation, humidity, evaporation, temperature and other factors which affect the utilization of water. This chapter on "Climatology" is followed by some valuable data relating to precipitation in the arid regions. Reliable figures on this subject have been infrequent and the collection presented here is of value.

The authors discuss at some length in following chapters the factors of evaporation, transpiration, and streamflow and runoff. Surface water rights are discussed.

Ground water hydrology and the movement and yield of ground waters are presented fully. The discussion of underground water rights is of interest and value. Though a matter not so well settled as yet, the trend appears to be away from the common-law doctrine, just as in the case of surface waters, where the doctrine of prior appropriation is now firmly fixed in our western states.

Space does not permit here of any discussion of the interesting chapters on the conflict and correlation between uses of water, on the administration of streams and on the valuation of water rights, but these are well worthy of study by hydraulic engineers.

The book is well written and the data it presents are arranged and coordinated for easy use.

Handbook of Lock-Bar Steel Pipe. Published by the East Jersey Pipe Co. 239 pages. In addition to giving complete data on Lock-Bar pipe, this handy book contains many tables and formulas and gives much general waterworks information of value to the hydraulic or waterwork engineer.